DOCUMENT RESUME

ED 062 623 AC 012 600

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TITLE Techniques for Analyzing Change in Literacy Rates and in the Number of Illiterates.
INSTITUTION Regional Office for Education in Africa, Dakar (Senegal).
PUB DATE Aug 70
NOTE 61p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Adult Education Programs; Adult Literacy; Age; Data Analysis; Evaluation Techniques; *Functional Illiteracy; *Literacy; *Mathematical Models; *Measurement Techniques; National Programs; Program Planning; Statistical Analysis; Tables (Data)
IDENTIFIERS *Senegal

ABSTRACT

The measurement of the evolution of illiteracy is the focus of this study. An elementary method for estimating the short-term evolution of the number of illiterates forms the subject of the first part of this analysis. This method is based on the demographic growth rate, the product of the school system and past trends. The second part is devoted to the examination of the evolution of the number of illiterates and of the rate of literacy in an attempt to arrive at coefficients which may facilitate the adoption of a literacy policy based more on rational than on empirical considerations. It is divided into two chapters, the first one relating to the evolution process of illiteracy. This evolution is influenced by the growth rate of the number of newly literate, the initial literacy rate, the rate of demographic growth, these various factors being taken together. The second chapter shows how to measure changes in the literacy rate and in the number of illiterates. Changes in the literacy rate depend on: the initial literacy rate; and the difference between the rate of increase of those made literate and the demographic growth rate. The number of illiterates diminishes when the rate of increase of those made literate is higher than the result of the demographic growth rate divided by the literacy rate of the previous year. (Author/DB)

REGIONAL OFFICE FOR EDUCATION IN AFRICA
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Techniques For Analysing Changes In Literacy Rates And In The Number Of Illiterates

...."the most monstrous, the most scandalous of all the many instances of wasted human potential : illiteracy, which still, at the present time, keeps more than one-third of the human race in a state of helplessness, below the level of modern civilization. When shall we make up our minds to eliminate this scourge from the face of the earth?"

Message from Mr. René Maheu,
Director General of Unesco,
on the 1st day of the year
1970 - International Education Year

FOREWORD

In the struggle waged by African countries to confirm the independence by modernizing the structures of their economy and their society, illiteracy sometimes appears as an index of poverty and, at others, as the cause of a specific impasse, but more often than not as a dangerous symptom of man's inaptitude for change.

A diagnosis is not a cure. Forging ahead is not enough eith Considering the present state of resources and the technical mean of disseminating knowledge, extr patience is needed to make a society literate. Enthusiasm an energy should be backed by ratio projects with successive targets classified according to urgent needs and priorities - according to strategy.

So what holds true for ende disease or, even more so, for tr ditional attitudes within social groups, also applies to illitera Its character, its magnitude, it tendencies must be identified. different national groups, the s and shape of the illiteracy prob varies. Blanket literacy programmes, which couple functional education for adults with school education for the young must depend on a specific diagnosis in which fine variables should be carefully examined:

- the population growth rate
- the population breakdown (per age group)
- the literacy rate for each age group
- the number of new literates trained through adult education
- the number of school-trained literates.

This study aims to offer a tool for making such analyses, for which the reader's patience and concentration will be more important than his mathematical skills. It may be used to evaluate the real impact of educational efforts on the progress made in literacy rates and numbers or to assess the scope of the effort needed to reach an objective defined in terms of rates or numbers in a given period of time.

As such, this tool may help planners, in view of the objectives and means available, to outline reasonable possible projects to be judged by the political leaders.

R. Hennion

TECHNIQUES
FOR ANALYZING CHANGE
IN LITERACY RATES
AND IN THE NUMBER OF ILLITERATES

by Christiane Vaugrante

Translated from the original
French text

Dakar, August 1970

CONTENTS

INTRODUCTION

Up to now, the ability to read and write has been, and continues to be, considered as an indispensable prerequisite for anyone to have access to any human culture. It is in recognition of the inherent value of literacy that the world has set about saving illiterates from their apparent fate.

Certainly this inability constitutes an ever-increasing handicap in the twentieth century. Nevertheless, it should be noted that ethnologists and sociologists, as well as community action leaders, have frequently emphasized, perhaps not sufficiently often, the importance of oral communication as well as its cultural role in African societies.

One of the key results of the Teheran Conference in September 1965 was that it viewed the elimination of illiteracy from a dynamic, operational standpoint; what was once considered as an evil in itself, to be eliminated as an inherent necessity, is now recognized, in addition, to be a brake on the very development and evolution of society.

Illiteracy stands in the way of the peasant who, in order to produce more and to dispose of his crops, needs to become familiar with new farming techniques, with the functioning of his cooperative, with the prevailing market conditions. Illiteracy stands in the way of the woman who has difficulty in grasping how to improve her children's upbringing and home conditions. It stands in the way of the worker who does not understand how to use his tools, who does not comprehend the order he is given. Again, the consumer emerging from a subsistence system to a monetary economy finds himself handicaped by his illiteracy. Illiteracy may also be the youngster who, poorly prepared for a vocation, looses the skills that he has no longer a chance to exercise. Finally, illiteracy may be the citizen who, used to live in a closed society, now finds himself forced to fit into a larger society, his nation and, consequently, obliged to find new modes of communication.

That is why, as the Teheran Conference concludes, adult literacy "must be closely linked to economic and social priorities and to present and future manpower needs. (...) Rather than an end in itself, literacy should be regarded as a way of preparing man for a social, civic and economic role". Consequently, it is now a question "that goes far beyond the limits of rudimentary literacy training consisting merely in the teaching of reading and writing.". The struggle against illiteracy cannot be useful and effective, nor will it have any sense, unless it is undertaken in relation to the promotion of man as a whole, with a view to giving the person concerned and the nation responsible for him a "raison d'être". "The very process of learning to read and write should

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be made an opportunity for acquiring information that can immediately be used to improve living standards; reading and writing should lead not only to elementary general knowledge but to training for work, increased productivity, a greater participation in civil life and a better understanding of the surrounding world, and should ultimately open the way to basic human culture." (Conclusion of the Teheran Conference.)

Within the framework of the overall effort undertaken by a society for its own development it is illogical to envisage making people literate if, at the same time, there is no coordination between this effort and schooling provided for the young.

The numerous countries which have acquired their independence since the Second World War have usually devoted their first efforts, following a now classical pattern, to the provision of schooling for the rising generations. However, the resulting costs have increased at such a pace that many have been obliged to revise their policy in this field. Those children and young people who already cannot be given schooling (and who will not be given it) will be added to the mass of illiterate adults. These are the adults to whom we should pay attention today, for whom we must find the means to enable them to exercise responsibility in their nations' future - a future which must be founded on development.

Learning, therefore, must be of innermost interest and must be integrated with the skills that are necessary for development. This is imperative if the most elementary knowledge and skills are to become a permanent part of an individual's intellectual equipment and if they are not to dissolve rapidly with the passage of time.

In view of these needs, literacy can be defined as being "of fundamental importance for full economic and social development, (...) without it there can be no complete and active participation of the peoples in national or international civic life.". (Preamble to the conclusions of the Teheran Conference.) This means that literacy must be functional.

In order to be truly functional, literacy campaigns must be planned and integrated within the framework of the overall development plans of individual countries.

An elementary method for estimating the short-term evolution of the number of illiterates forms the subject of the first part of this analysis. This method is based on the demographic growth rate, the product of the school system and past trends.

The second part is devoted to the examination of the evolution of the number of illiterates and of the rate of literacy in an attempt to arrive at coefficients which may facilitate the adoption of a literacy policy based more on rational than on empirical considerations. It is divided into two chapters, the first one relating to the evolution process of illiteracy. This evolution is influenced by the growth rate of

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the number of newly literate, the initial literacy rate, the rate of demographic growth, these various factors being taken together.

The last chapter shows how to measure changes in the literacy rate and in the number of illiterates. Changes in the literacy rate depend on :

- the initial literacy rate;
- the difference between the rate of increase of those made literate and the demographic growth rate.

The number of illiterates diminishes when the rate of increase of those made literate is higher than the result of the demographic growth rate divided by the literacy rate of the previous year.

The measurement of the evolution of illiteracy, taking into account school production, makes it possible to assess the efforts needed for certain objectives expressed in terms of literacy and to define and establish strategies in relation to the available resources.

Before planning a literacy project of some magnitude in any given country, it is necessary to proceed with some calculations of simple ratios which are essential in order to determine which objectives are realistic and which strategies are the best.

* * *

PART ONE

SHORT-TERM ESTIMATE OF THE NUMBER OF ILLITERATES

CHAPTER I. AN ELEMENTARY METHOD(1) FOR ESTIMATING THE SHORT-TERM EVOLUTION OF THE NUMBER OF ILLITERATES

In 1950, the number of illiterates in the world was estimated at some 700 million; since 1950 (not taking account of the four following countries : China mainland, North Korea, North Vietnam and South Africa) their number has increased. In a large number of African countries, although the rate of illiteracy is declining the number of illiterates is increasing. This fact can be largely explained by the relatively low capacity of the educational system compared with the demographic growth; a high proportion of children of the school-age population have no opportunity of going to school and will therefore join the illiteracy group when they reach adulthood.

The growing mass of illiterates can also be explained by the poor educational yield and by the weakness of the resources made available for adult education.

Illiteracy is not a problem peculiar to any particular part of the world or to any particular group of countries. It is present everywhere, but to a more or less noticeable extent. In any given country it may vary according to age and sex, environment, socio-professional groups, and so on. Even if it is sometimes difficult to lay down a clear distinction between who is and who is not illiterate(2) it is desirable that some indicators should emerge from a study of the quantitative evolution of literacy.

One may say that at the time t_n the number of illiterates aged from 15 to 65 and over may be estimated as being equal to the sum of the number of illiterates by five-year age-groups, by taking as the rate of increase from t_o to t_n for each age-group the rate of natural growth of the total population, and by taking as the illiteracy rate at the time t_n the illiteracy rate at time t_o of the age-group n years younger.

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(1) Instead of using, as we did, the same rate of increase for all, it would have been preferable to use survival rates. We have adopted the formula stated for the sake of its ease of use.

(2) For a definition of "illiteracy", "literate", see "Illiteracy in the World, XXth Century", Unesco, Paris, 1957, and the papers relating to the World Conference of Ministers of Education on the Eradication of Illiteracy - Teheran, 8 - 19 September 1965.

It is to be noted that if n = 5 years, the illiteracy rate for the age-group 10-14 is represented by the difference from 100 of the highest rate of school attendance by age from 10 to 14 at time t_o; if n = 10 years, the rate for the age-group 5 - 9 can only be an estimate based on the growth trend of the school system.

This may be expressed in the formula :

(1) $$I_{tn} = \sum_{i = 15 - 19}^{i = 65 \text{ \& over}} P_{i_{to}} \quad (1 + r)^n \quad (1 - \alpha i)_{to}$$

where :

I represents the number of illiterates aged 15 and over

P_i represents the population of the age-group in question

r represents the natural rate of population growth

$1 - \alpha i$ represents the illiteracy rate of the age-group in question.

Nevertheless, the formula (1) does not take into account new literates formed during the period under consideration (represented by A) nor illiterates by relapse (represented by W), that is to say children who leave primary school before completing the fourth grade, the period of instruction regarded as the minimum period for the irreversible attainment of a threshold of literacy.

So the formula now becomes :

(2) $$I_{tn} = \sum_{i = 15 - 19}^{i = 65 \text{ \& over}} Pi_{to} \, (1 + r)^n \, (1 - \alpha i)_{to} - \sum_{j = o}^{j = k} A_{tj} + \sum_{j = o}^{j = k} W_{tj}$$

In order to know the value of A, one will take account only of new-literates who have passed beyond the phase of acquisition of basic mechanisms of reading, writing and arithmetic. It is assumed that two sessions of eight months each with three two-hour periods each week are necessary to acquire these basic elements when the language used is not the mother tongue. The first session is devoted to the acquisition of the basic elements, while the second aims at mastery of these basic tools.

To obtain the value of W, one can base oneself on the data collected by the school statistics service. The following calculation has to be made at the national level.

The number of school-leavers S for a grade gi is equal to the difference between the enrolment E of that grade in t_o and the sum of those promoted (or newly enrolled) to the next higher grade g(i + 1) in t_1 and the repeaters R in the same grade gi in t_1 (promoted and repeating in t_1).

$$(3) \quad S(g_i, t_o) = E(g_i, t_o) - \left[P(g_i + 1, t_1) + R(g_i, t_1)\right]$$

As a general rule, the basic data available concern the enrolment (P + R) and the number of repeaters. The number of those promoted is obtained by subtraction.

$$(4) \quad P(g_i + 1, t_1) = E(g_i + 1, t_1) - R(g_i + 1, t_1)$$

So we have :

$$(5) \quad S(g_i, + t_o) = E(g_i, t_o) - \left[E(g_i + 1, t_1) - R(g_i + 1, t_1)\right] - R(g_i, t_1)$$

That is :

$$(6) \quad \boxed{S(g_i, t_o) = E(g_i, t_o) - E(g_{i+1}, t_1) + R(g_{i+1}, t_1) - R(g_i, t_1)}$$

For example, out of the children enrolled in grade 1 in 1962/63, the number leaving school will be :

$$(7) \quad S\ (1,1962) = E\ (1,1962) - E\ (2,1963) + R\ (2, 1963) - R\ (1,1963)$$

To find the number of school-leavers in the second and third grades one would have :

$$(8) \quad S(2,1962) = E(2,1962) - E(3,1963) + R(3,1963) - R(2,1963)$$

$$(9) \quad S(3,1962) = E(3,1962) - E(4,1963) + R(4,1963) - R(3,1963)$$

To find the sum of the school-leavers from grade 1, 2 and 3, one adds together the component of the equations (7), (8) and (9).

So we have :

$$\begin{aligned}(10) \quad S(1+2+3,\ 1962) = {} & E(1,1962) - E(2,1963) + R(2,1963) - R(1,1963) \\ & + E(2,1962) - E(3,1963) + R(3,1963) - R(2,1963) \\ & + E(3,1962) - E(4,1963) + R(4,1963) - R(3,1963)\end{aligned}$$

Simplifying, we have

$$(11)\quad S\ (1+2+3,\ 1962) = E\ (1+2+3,\ 1962) - E\ (2+3+4,\ 1963) + R\ (4,\ 1963) - R\ (1,\ 1963)$$

or

$$(12)\quad \boxed{S\ (1+2+3,\ t_o) = E\ (1+2+3,\ t_o) - E\ (2+3+4,\ t_1) + R\ (4,t_1) - R\ (1,\ t_1)}$$

The formula (12) gives for each school year the number of children leaving school before the fourth grade, i.e. the value for W.

W equals - the difference between the enrolments of grade 1, 2 and 3 in the school year t_o (the school-year for which one wishes to discover the number of leavers) and the enrolments of grade 2, 3 and 4 for the following school year t_1, - plus the difference in the school year t_1 between the number of repeaters in grade 4 and the number in grade 1.

This can also be expressed in the following form :

The number of children leaving school before reaching grade 4 in a given school-year t_o is equal to the sum of two differences, viz.

- the difference between the enrolments of the three first grades in two successive school years, the year under consideration and the following one, i.e. t_o and t_1,
- plus the difference for the school year t_1 between the children newly enrolled P in the first grade and those newly enrolled (P) in the fourth grade.

This may be expressed :

$$(13)\quad \boxed{S\ (1+2+3,t_o) = E\ (1+2+3,t_o) - E\ (1+2+3,t_1) + P\ (1,\ t_1) - P\ (4,\ t_1)}$$

By using formula (12) or (13) one obtains various equations giving for a number of school years the number of children leaving school before reaching the fourth grade from t_o to t_n.

$$(14)\quad \sum_{j=o}^{j=k} S\ (1+2+3,t_j) = E(1+2+3,t_o) - E(2+3+4,t_{k+1}) + R(4,t_{k+1}) - R(1,t_{k+1})$$

$$+ \sum_{j=1}^{j=k} \left[P\ (1,t_j) - P(4,t_j) \right]$$

$$(15)\quad \sum_{j=o}^{j=k} S(1+2+3,t_j)=E(1+2+3,t_o)-E(1+2+3,t_{k+1}) + \sum_{j=1}^{j=k+1}\left[P(1,t_j) - P(4,t_j)\right]$$

It seems that as a general rule the calculations can be made by using the formula :

$$(16)\quad \sum_{j=o}^{j=k} S(1+2+3,t_j)=E(1+2+3,t_o)-E(1+2+3,t_{k+1})+ \sum_{j=1}^{j=k+1} E(1,t_j)- \sum_{j=1}^{j=k+1} E(4,t_j) - \sum_{j=1}^{j=k+1} R(1,t_j) + \sum_{j=1}^{j=k+1} R(4,t_j)$$

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CHAPTER II. APPLYING THE METHOD

Evolution of the estimated number of illiterates in Senegal from 1960 to 1970

Basis for calculation : raw data concerning population in 1960 (see Table I and the pyramid)

First case

Not taking into account :

(a) Quantitative influence of literacy campaigns

(b) Illiterates by relapse

1) Estimation, by age group and by sex, of the 1970 population

Considering that every year the rate of increase of the population is r, we have :

$$P_{1970} = P_{1960}\,(1+r)^{10}$$

Here r has been considered as equal to 2.2% = 0.022

$$(1 + r)^{10} = (1 + 0.022)^{10} = 1.022^{10} = 1.24$$

Hence

$$P_{1970} = P_{1960} \times 1.24$$

2) Estimation by age group and by sex, of the rate of illiteracy in French[1]

(i) For the age group 25 - 29 and above :

It is estimated (point (a)) that the rate of illiteracy for the age group 25-29 in 1970 is equivalent to the illiteracy rate for the age group 15 - 19 in 1960; for the age group 30 - 34 in 1970 one refers to the age group 20 - 24 in 1960, and so on.

(ii) For the age group 20 - 24 :

It is estimated that the rate of literacy for this age group will be, as a maximum, equivalent to the highest rate of school attendance (not Koranic schools) by age from 10 to 13 in 1960 (point (b) and Table II).

The rate of illiteracy will then be the difference between 100 and this rate of school attendance.

(iii) For the age group 15 - 19 :

The same kind of argument as in (b) but referring to the age groups 10 - 13 in the year 1964 (see Table III).

3) Calculation, by age group and by sex, of the number of illiterates in 1970

One multiplies the estimated number in each age group by the corresponding illiteracy rate.

Example : it is estimated that the age group 25-29 of male sex consists in 1970 of 148,000 persons, with an illiteracy rate estimated at 80 % (equivalent to the illiteracy rate of the age group 15 - 19 in 1960). Hence the number of male illiterates aged 25 - 29 in 1970 :

$$148{,}000 \times 0.80 = 118{,}400$$

4) Estimation for the year 1970 of the total number of illiterates aged 15 and over

The sum of the age groups gives 844,700 male illiterates and 1,049,500 female illiterates - so for 1970 approximately 1,894 thousand of illiterates aged 15 and over.

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(1) The knowledge of French has been chosen as the measure of the illiteracy rate, as the object of literacy campaigns in Senegal has been, until 1967, to permit the acquisition of the mechanics of reading and writing in French.

5) Increase by 1970, in comparison with 1960, of the number of illiterates

The result obtained above is compared with Table I.

In 1960, the number of people aged 15 and over knowing how to write French was 86,900 males and 10,500 females, making 97,400 altogether.

Considering the total number of the population of 15 and over, the number of illiterates worked out as follows :

Males	749,200
Females	904,000
Total	1,653,200

Hence from 1960 to 1970 the number of illiterates will have grown by 240,000 (slightly less than 100,000 males and about 150,000 females), that is to say, an average annual increase of 24,000 illiterates.

Second Case

Taking into account :

(a) Literacy campaign

(b) Illiterates by relapse

Previously, we considered the influence of literacy campaigns as negligible.

However, a literacy campaign was launched in Senegal at the beginning of 1966. According to the report to the National Evaluation Committee in January, 1967, presented by one representative of the Ministry concerned, 3,000 people aged 15 and over were enrolled during 1966 in the literacy centres. This figure does not indicate the number of people who have regularly attended literacy classes. The official responsible for one centre near Dakar city quoted, at the same meeting, the figure of 41%, as representing the proportion of people who regularly attended literacy classes and who thus acquired in 1966 the basic mechanics of reading and writing. If we apply this success percentage to the total number of enrolled students, we arrive at 1,230 people made literate.

We can say then that in 1966 the number of new literates was between 1,200 and 1,300. This figure appears trivial in comparison with the annual increase in the number of illiterates. However, it is fair to make clear that for 1966 the object of the campaign was more particularly to make people aware of the problem of illiteracy.

The point (b) that we also adopt in this second case is the presence of illiterates by relapse. As mentioned on page 7 , we mean by this term those children who leave the primary school before having reached grade 4 - that is to say CE_2 in Senegal.

The statistics published by the Ministry of Education ("Statistiques Scolaires" 1963/64, 1964/65, 1965/66) provide us with the statistical data necessary for the application of formula (16) and we can calculate the number of pupils who, in 1963, 1964 and 1965, left school without crossing the threshold of grade 4 (cours élémentaire, deuxième année, or CE_2).

According to formula (16), it emerges that this number of school-leavers is equal to :

(1) the enrolment of the first three grades (C.I, C.P., $C.E._1$) in 1962/63, that is 113,827,

(2) less the enrolment of the first three grades in 1965/66; that is 122,045,

(3) plus the sum of the pupils enrolled in the first grade (C.I.) from 1963/64 to 1965/66, that is 129,200,

(4) less the sum of the pupils enrolled in the fourth grade ($C.E._2$) from 1963/64 to 1965/66, that is 95,815,

(5) less the sum of the repeaters in the first grade (C.I.) from 1963/64 to 1965/66, that is 17,369,

(6) plus the sum of the repeaters in the fourth grade ($C.E._2$) from 1963/64, that is 13,462.

So the number of pupils leaving the primary school from 1963 to 1965 before having reached grade 4 is :

(1)	-	(2)	+	(3)	-	(4)	-	(5)	+	(6)	
113,827	-	122,045	+	129,200	-	95,815	-	17,369	+	13,462	= 21,260

It can be estimated, then, that between 1960 and 1970, among all the children who will leave primary school, about 70,000 will not have reached the threshold of literacy. These children are to be added to the numbers of those who have not been schooled in elementary reading, writing and arithmetic.

In order to know the average annual increase of the number of illiterates between 1960 and 1970, we should :

(1) subtract the number of new literates trained in the adult courses from the number of illiterates found on page 12,

(2) add to the result obtained the number of school leavers who have not reached the threshold of literacy (grade 4).

Finally, between 1960 and 1970, the increase in the number of illiterates each year exceeds 24,000 and approaches 30,000.

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The available data only allows us to make estimates. But they provide a general idea of sizes. It is interesting to note that efforts in adult literacy are cancelled out - or even worse - by the school drop-out rates. We also see what the annual number of literates through adult education would have to be if it is to have any change on the overall number of literates. And then, the cost of school failures, added to the costs involved in making adults literate, considerably increases the marginal costs defrayed for the new literates.

So one can hardly insist too strongly upon the need to coordinate adult literacy projects - whether functional literacy or not - with the policy for development of the school system.

TABLE I

SENEGAL - African population in 1960/61 according to knowledge of French (in thousands)

Age	Does not understand	Under-stands	Speaks	Reads	Writes	Not stated	Total
			Males				
14	14.1	0.1	0.1	-	7.6	-	21.8
15-19	77.8	2.4	1.5	0.1	20.7	0	102.5
20-24	79.4	4.2	3.2	0.2	14.7	0.1	101.7
25-29	94.9	6.0	5.7	0.2	12.3	0.1	119.2
30-34	79.0	5.8	6.8	0.3	9.9	0.1	101.9
35-39	69.1	5.4	5.3	0.2	8.3	0	88.4
40-44	52.7	5.8	4.1	0	6.2	0	68.9
45-49	55.6	4.9	3.7	0.5	5.7	0.1	70.5
50-54	41.6	3.0	2.3	0.1	4.0	0	51.0
55-59	35.8	2.0	2.0	0.1	2.7	-	42.6
60	79.0	4.1	3.7	0.1	2.5	-	89.4
Total	679.0	43.7	38.3	1.8	94.5	0.5	857.9
			Females				
14	13.3	0	0	-	2.3	-	15.6
15-19	122.0	0.7	0.6	0.1	5.7	0.2	129.3
20-24	136.5	0.5	0.7	0	2.2	0	140.0
25-29	159.2	0.6	0.4	0	1.2	-	161.4
30-34	108.1	0.3	0.5	-	0.7	-	109.6
35-39	93.6	0.2	0.2	-	0.3	-	94.2
40-44	64.6	0.1	0.1	-	0.2	0.1	65.1
45-49	59.6	0.2	0	-	0.1	0	60.0
50-54	42.1	0	0.1	-	0	-	42.2
55-59	30.7	0.1	0.1	-	-	0	30.8
60	81.7	0.1	0.1	-	0.1	0	81.9
Total	911.4	2.8	2.8	0.1	12.8	0.3	930.1

Source: "La population du Sénégal" (L. Verrière, Dakar, 1965)

TABLE II

SENEGAL - School attendance of African population of school-age, by age, 1960 (in thousands)

Age	Total population	Not at school	At school		Not stated
			Koranic	Other	
		Boys			
5	56.2	52.0	0.3	3.6	0.3
6	51.4	40.7	8.4	1.9	0.4
7	56.2	34.0	10.6	11.5	0.1
8	45.9	25.2	8.6	11.9	0.2
9	35.2	18.9	5.7	10.6	0
10	31.8	16.0	5.9	9.8	0
11	28.5	15.3	3.8	9.3	0.1
12	27.4	14.8	4.4	8.2	0
13	26.0	14.3	3.9	7.8	-
Total 6-13	302.4	179.3	51.3	71.0	0.8
		Girls			
5	56.7	54.5	1.7	0.2	0.3
6	51.2	45.9	3.4	1.7	0.2
7	49.1	38.6	3.0	7.4	0.1
8	41.0	31.9	2.3	6.7	0
9	32.5	24.8	1.7	5.8	0.2
10	28.2	21.4	1.4	5.4	0.1
11	22.3	17.1	0.9	4.1	0.1
12	26.3	20.7	1.1	4.4	0.1
13	22.4	18.3	0.6	3.3	0.2
Total 6-13	273.0	218.8	14.4	38.8	1.1

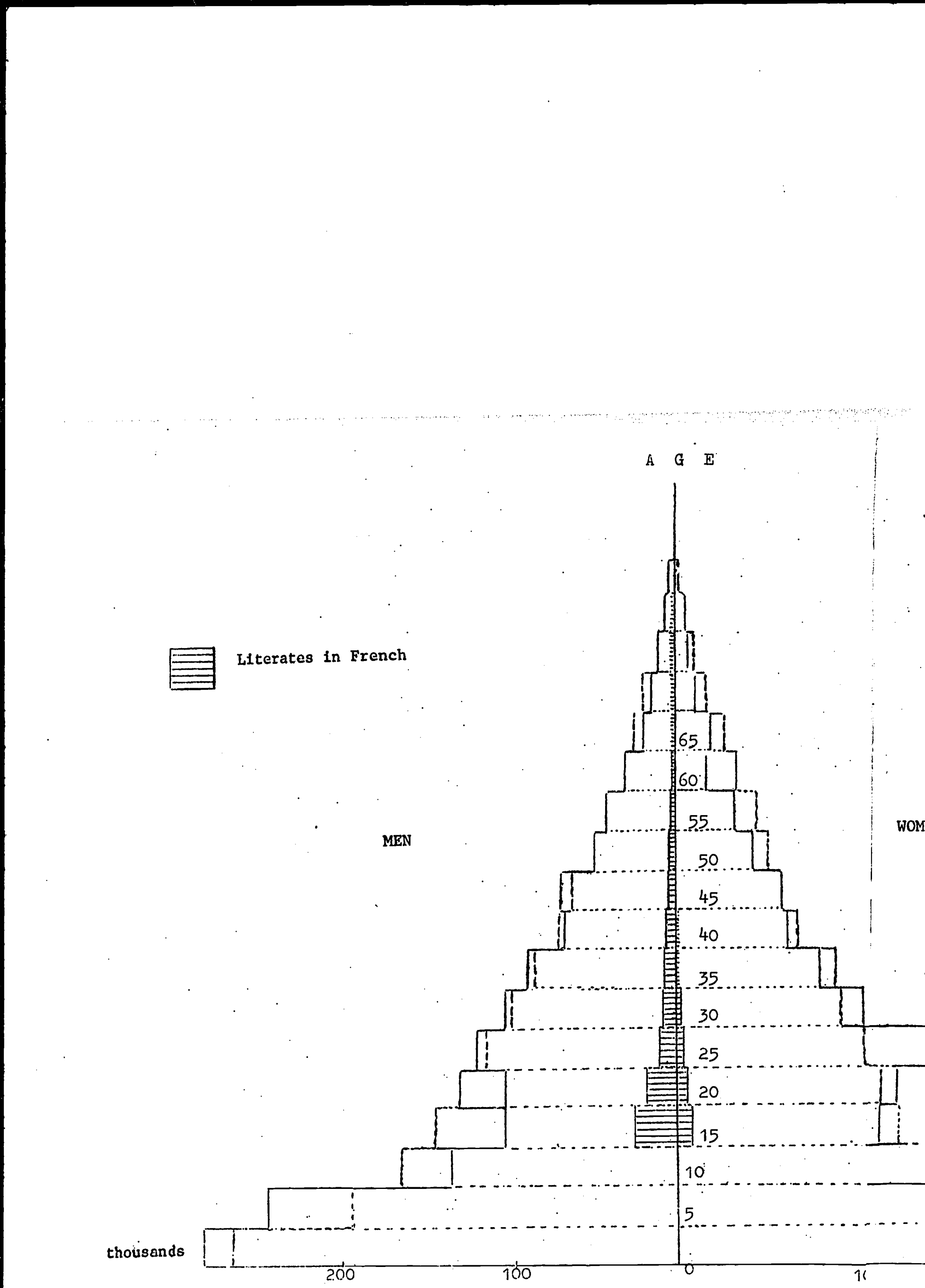
Source: "La population du Sénégal" (L. Verrière, Dakar, 1965)

TABLE III

SENEGAL - Estimation of school enrolment rates, as at 1.1.64

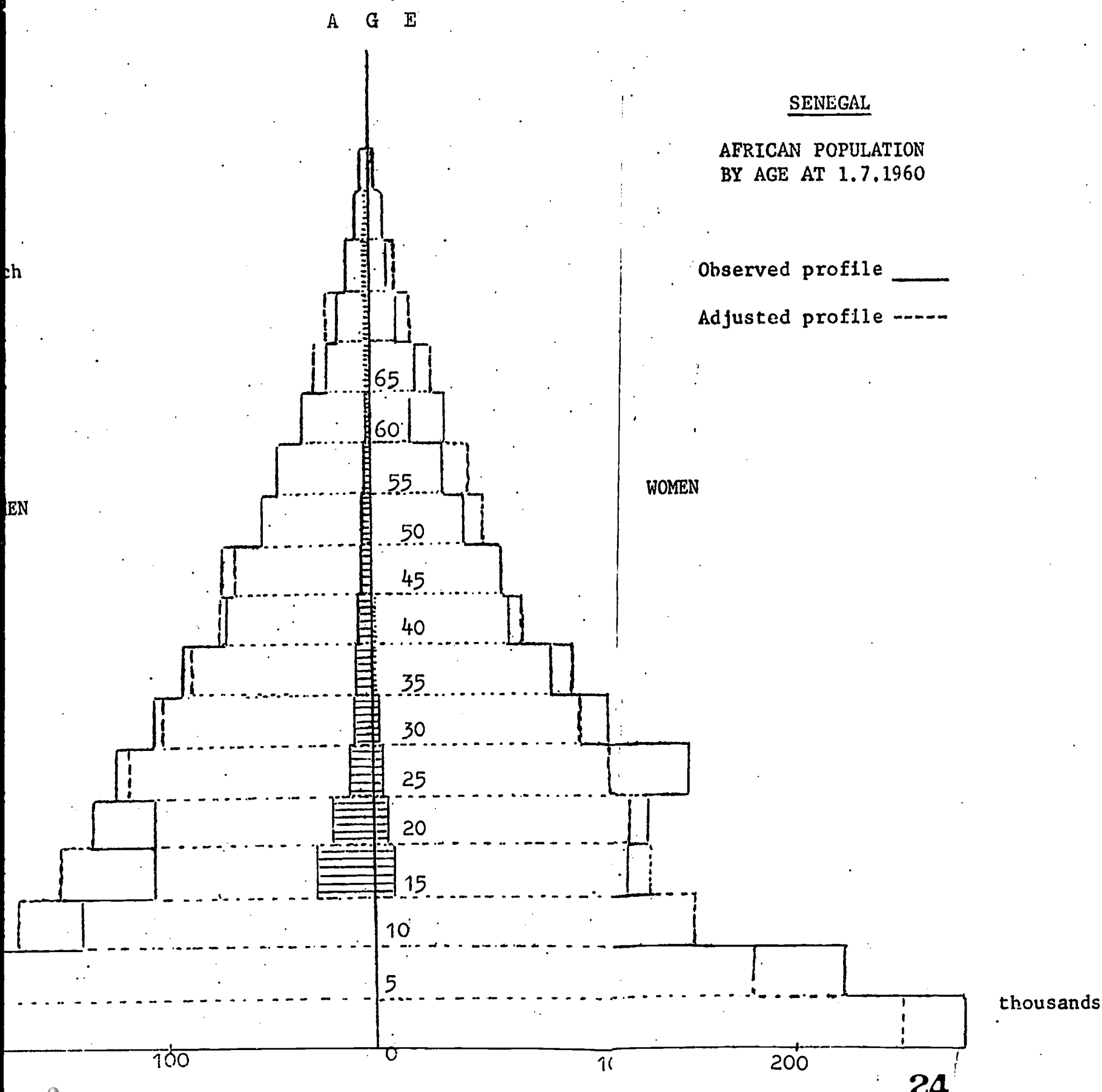
Age as at 1.1.64	Enrolment rate (%)	
	Boys	Girls
10	47.0	24.5
11	49.6	22.3
12	40.0	17.7
13	38.8	14.0

Source: "Statistiques Scolaires, 1963/1964",
Ministère de l'Education Nationale du Sénégal


A G E
Literates in French
MEN
WOM
65
60
55
50
45
40
35
30
25
20
15
10
5
thousands
200
100
0

SENEGAL

AFRICAN POPULATION
BY AGE AT 1.7.1960



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PART TWO

ANALYZING CHANGES IN ILLITERACY RATES

CHAPTER I - TRENDS IN ILLITERACY

In this chapter we are going to examine how illiteracy rates change in a given country, as measured by the illiteracy rates or the number of illiterates. As a result of this study on the literacy trends it will be possible to establish coefficients which will be useful in working out a literacy policy on a rational rather than an empirical basis.

In a certain country at a given date, for instance, the number of illiterates aged 10 years and over is equal to the number of people who are 10 years old and older, minus the number of literates of that same age group.

If the number of literates increases at a rate which is lower than the population growth rate, the number of illiterates will increase. What will happen if the number of literates increases faster than the population? The number of illiterates will not automatically drop; there will only be a decrease in the number of illiterates under certain conditions - which we will set out further on.

Let us take an example :

A country with a population growth rate of 3% has a 20% literacy rate for the 10 years and over age group. What conditions are required to make the number of illiterates drop? We could reword the question : how could this country increase the number of literates and, thereby, curb the spread of illiteracy?

Among the various cultural, social and economic factors which underly the literacy level, the most important one is, obviously, the education given to children in primary school. If all the school age children in a country attend school long enough, after a certain number of years the population will no longer comprise any illiterate adults, besides those few who suffer from mental handicaps and are unable to learn how to read and write. The best way, then, of eliminating illiteracy is to provide enough education for the children.

This, however, requires time, and countries with a 90, 80 or 70% illiteracy rate are quite rightly anxious to shorten this time as much as possible. For this reason mass literacy campaigns were put into operation and, more recently, functional and selective literacy projects have been

.../...

carried out, some of which have received assistance from Unesco and from the U.N. Special Fund. These projects aim to provide the training needed for adults to be able to integrate themselves quickly into the economic wheels of their country.

At the outset we must say that the number of people enrolled in literacy classes does not correspond to the number of new literates, just as the total number of students enrolled in primary education cannot be considered as an estimate of the number of school trained literate children.

The case of literacy campaigns was briefly examined in Part One.

The estimated number of school trained literates will be based on the number of students who reach the fourth form, or, more precisely, the number of new school trained literates will be represented by the total number of students who are promoted from the fourth to the fifth year of studies and the students who leave school at the fourth year level.

In countries where repetition of a form is prevalent, the number of new school trained literates can be calculated by subtracting the number of students who, in t_1, are to repeat courses at the fourth year level from the number of fourth year students in t_o. (Repeaters are not taken into consideration because students who repeat a form would be counted twice in the statistics covering two successive school years.)

In many of these countries where pupils are not always automatically promoted, data on the number of repeaters for each year of study and for several school years are not yet available. When this is the case, the number of school trained literates can be estimated by taking the total number of students enrolled in the fourth year of studies.

In the country under consideration, the average annual rate of increase for literates is 10%.

Graph 1 (page 21) shows the trend in illiteracy in this country(1), assuming that the population growth rate and the literacy growth rate remain constant throughout several years.

The graph clearly shows that the number of literates age 10 and over increases more quickly than the population of that same age group. What can be said about the number of illiterates represented by the distance between the two curves?

.../...

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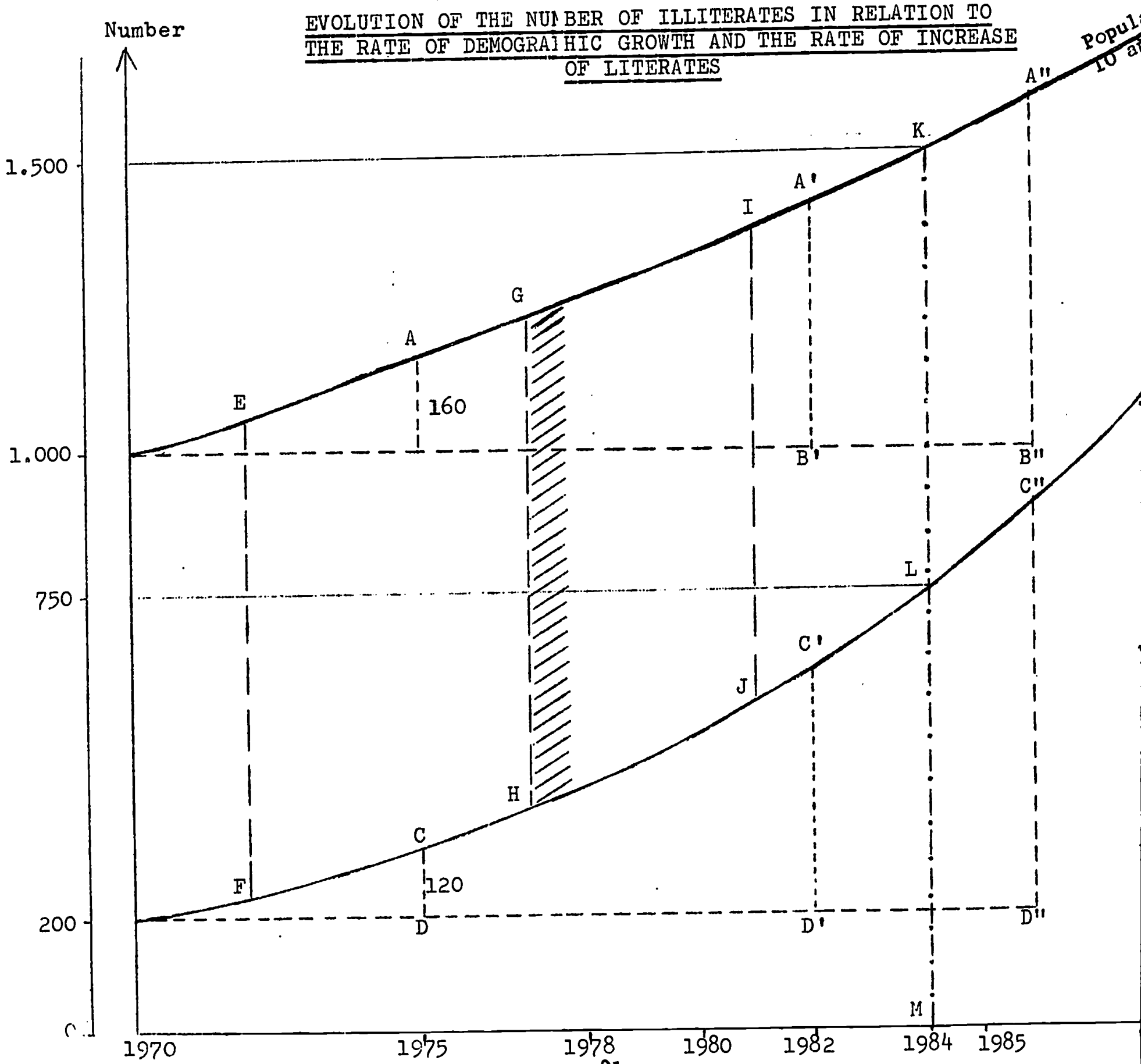
(1) Not taking into account that the per age group literacy rates are higher for young age classes.

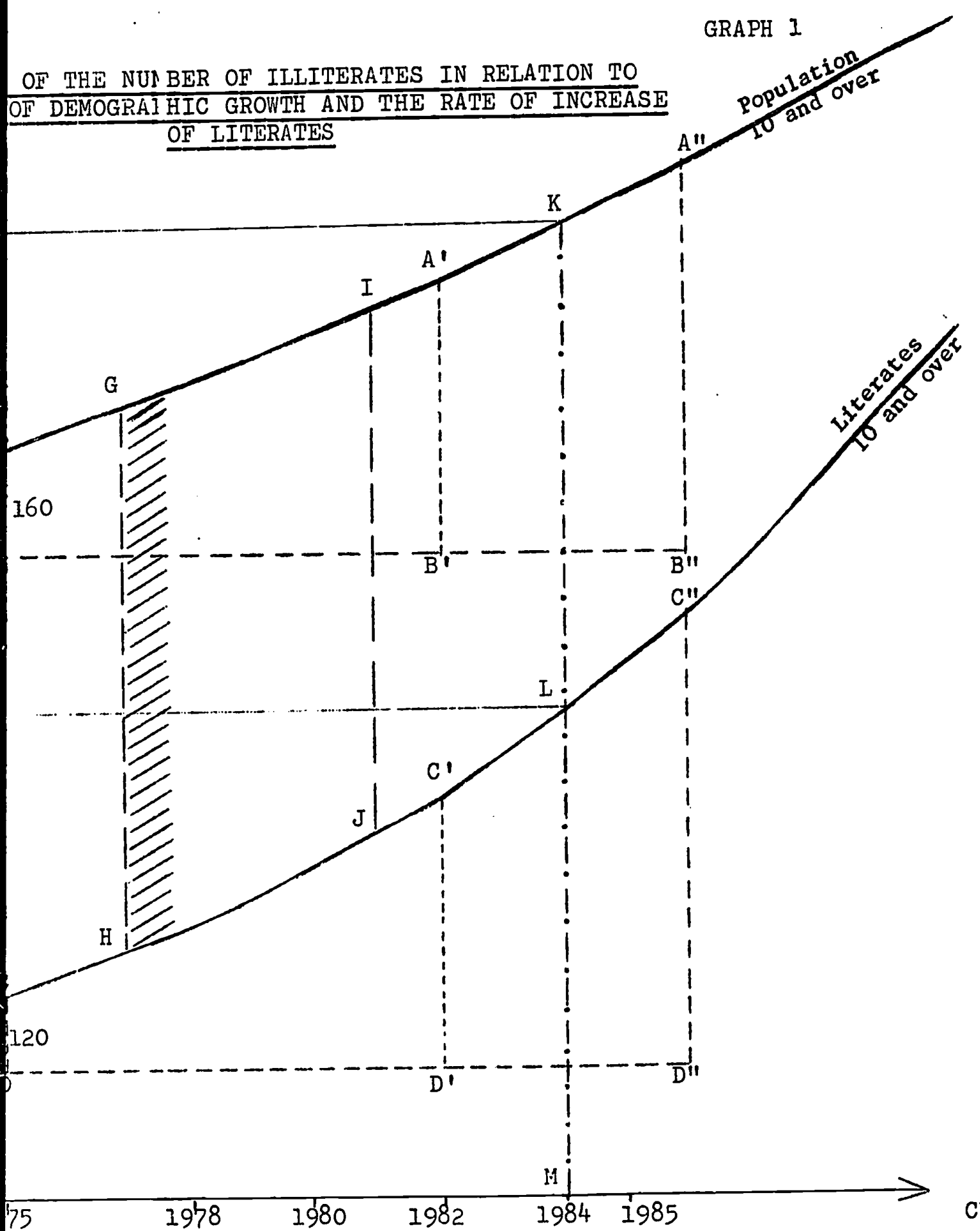
GRAPH 1

EVOLUTION OF THE NUMBER OF ILLITERATES IN RELATION TO THE RATE OF DEMOGRAPHIC GROWTH AND THE RATE OF INCREASE OF LITERATES



GRAPH 1

OF THE NUMBER OF ILLITERATES IN RELATION TO
OF DEMOGRAPHIC GROWTH AND THE RATE OF INCREASE
OF LITERATES



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At the outset, the number of illiterates in the ten year and older age group is equal to the population of that same age group (1,000) minus the number of literates in that age group (200), that is, 800.

By drawing, from 1,000 and 200, two lines which are parallel to the axis representing the years, and by measuring the distance from these parallels to the population curve and to the literates' curve, it is possible to assess the increase in the number of illiterates.

Vertical line AB, covering 160 people, represents the increase in the population, which, in 1975, thus, is equal to 1,000 + 160, i.e. 1,160. Vertical line CD, covering 120 people, represents the increase in the number of literates, so the figure by 1975 is 200 + 120, i.e. 320. In 1975, then, the number of illiterates is 1,160 - 320, or 840, which represents an increase of 840 - 800, i.e. 40 since 1970.

The increase in the number of illiterates could be calculated by taking the difference between AB and CD, i.e. 160 - 120 = 40, so, in 1975, the number of illiterates is 800 + 40 = 840.

The difference between the lines AB and CD shows us whether the number of illiterates has increased or decreased.

In 1975, AB is longer than CD, which means that the number of illiterates has increased since 1970.

In 1982, A'B' is equal to C'D', which means that the number of illiterates, at that date, is the same as at the starting date, therefore between the end of 1975 and the beginning of 1982 the number of illiterates has declined.

After 1982, lines parallel to AB are shorter than those parallel to CD; A"B" is shorter than C"D", which means that each year the number of illiterates decreases in comparison to the 1970 and 1982 figures, since no increase or decrease was registered at the latter date.

So, after climbing (the graph shows up to GH or 1977), the number of illiterates declines as from 1978. By reading the graph we can see that the literacy rate reaches 50% in 1984 when line KL, which represents the number of illiterates is equal to line LM, which represents the number of literates.

In the country under consideration the trend in illiteracy can be summarized as follows :

1) Increase in the number of illiterates, 1970 - 1977;

2) Continuous decrease in the number of illiterates as of 1978 with :

.../...

a) the same number of illiterates in 1982 as at the starting date, then

b) 50% literacy in 1984.

Can we say that these different stages of development in eradicating illiteracy are characteristic of the phenomenon we are studying or do they only apply to a given country, in which case their applicability is restricted?

1. Effects of the increase rate of literates

Graph 2 (page 24) shows the trends in illiteracy in two countries where the population growth rate is 3% and where the illiteracy rate at the beginning is 80% and the literacy rate 20%. In one country (A) the rate of increase for literates is 10% and in the other (B) it is 6%.

In country A - which has the same characteristics as the country in the preceding graph - the curve representing the number of literates shows that in the beginning the number increases slightly and then slopes off, slightly at first and then more sharply. The literacy rate reaches 50% after about 14 years, as shown at the point where the two curves intersect.

The number of literates in B increases but, of course, more slowly than in A, and although the average annual rate of increase (6%) is double the population growth rate, the number of literates in B continues increasing at least throughout the 25 years covered by the graph.

In A, after eight years the number of illiterates starts decreasing although the illiteracy rate is still 66%, while in B the number of illiterates will start decreasing after 33 years, at which time the illiteracy rate will be around 48%.

In A, after 14 years the illiteracy rate is 50% and the literacy rate 50% too, at which time the number of illiterates is already 5% lower than at the outset.

In B, the illiteracy rate reaches 50% after 32 years and, at that time, the number of illiterates (which has not yet started dropping) is 50% higher than at the outset.

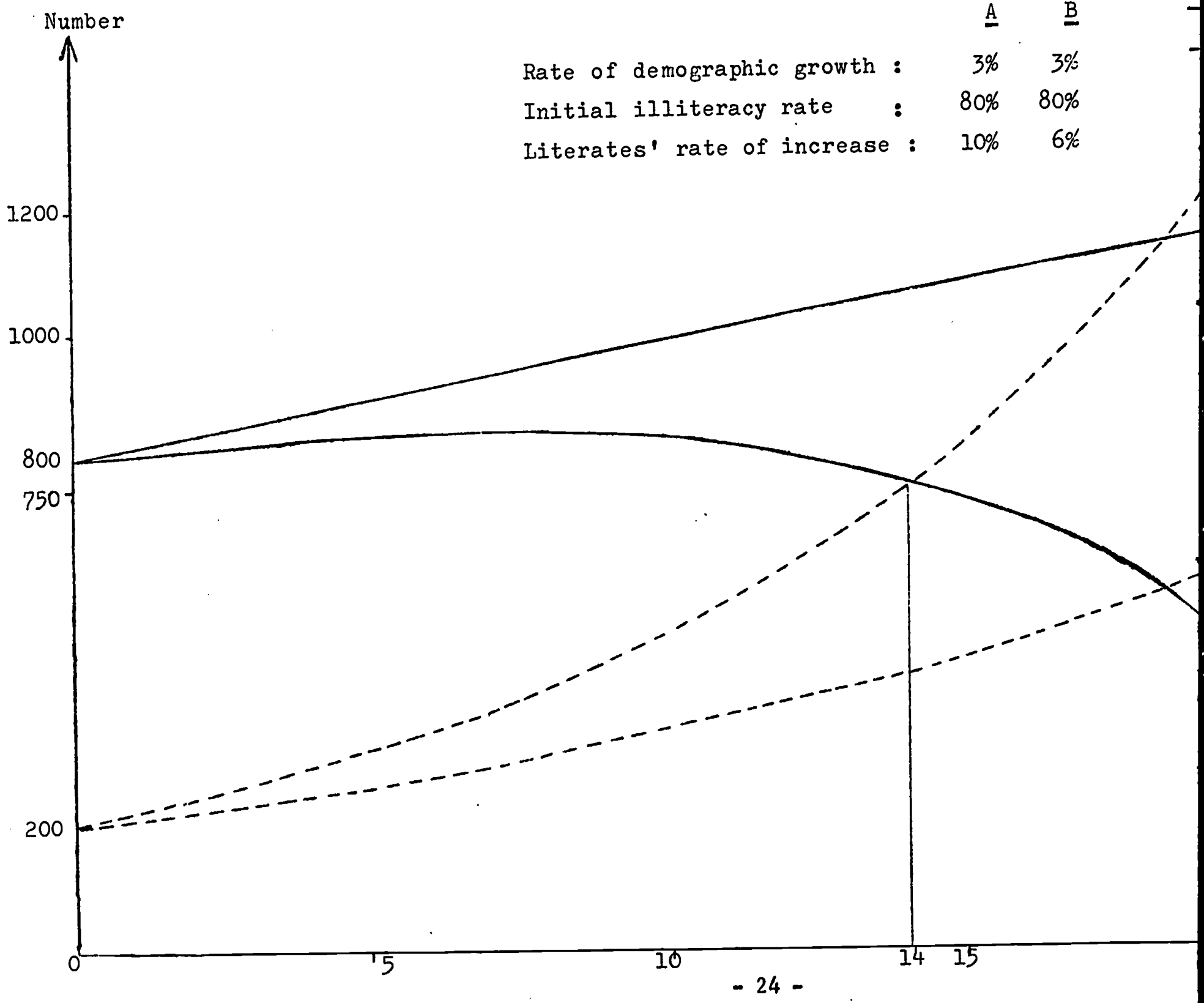
In A, the decrease occurred before the 50% rate was reached, while in B the decrease occurred almost at the same time as the 50% rate was reached.

A comparison of the trends in illiteracy in these two countries where the only difference lies in the rate of increase of literates (6% and 10%) shows, which common sense suggests, that the increase in the number of literates has a considerable effect on the evolution of illiteracy.

.../...

EVOLUTION OF THE NUMBER OF ILLITERATES AND THE NUMBER OF LITERATES

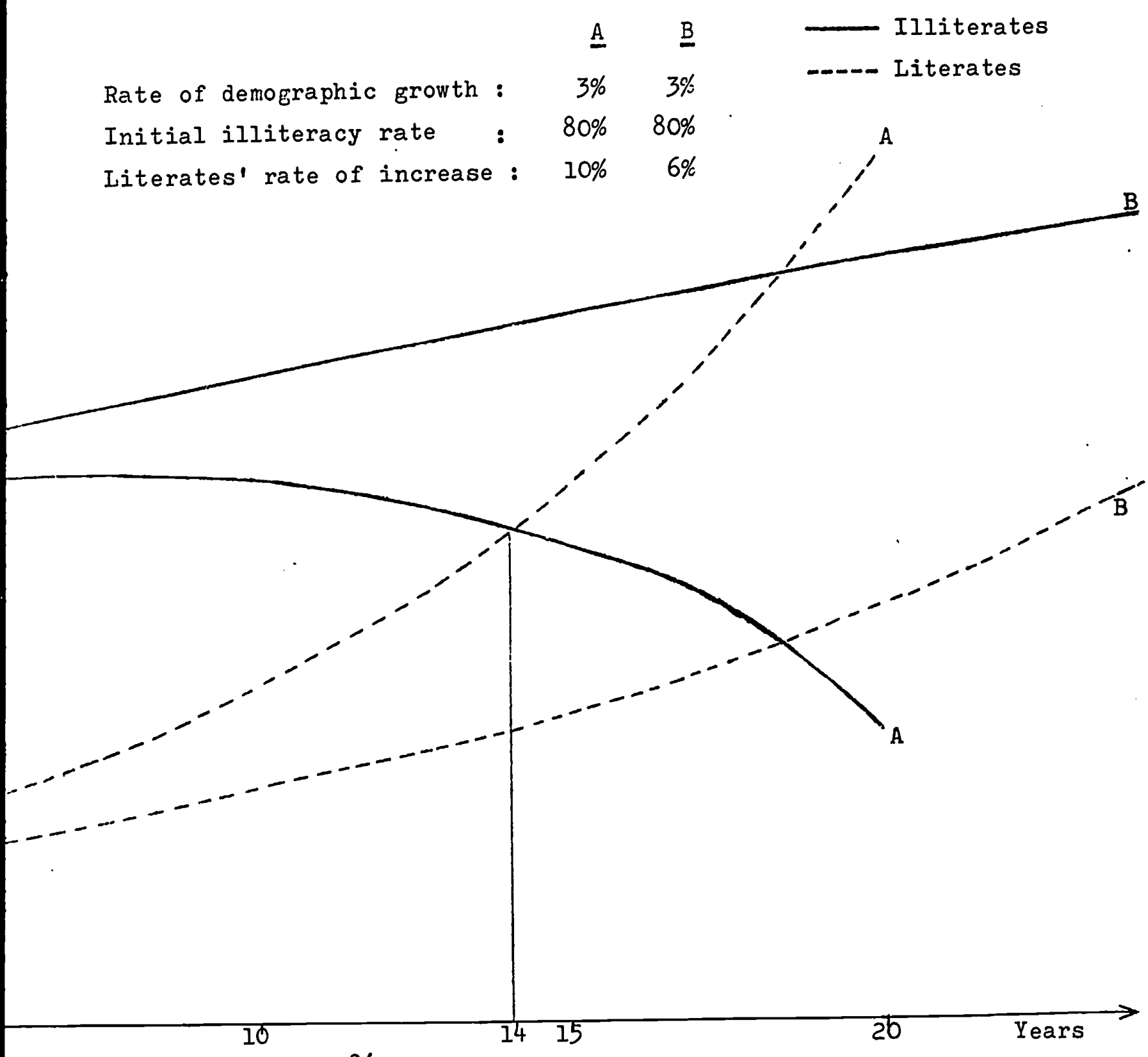
	A	B
Rate of demographic growth :	3%	3%
Initial illiteracy rate :	80%	80%
Literates' rate of increase :	10%	6%



GRAPH 2

THE NUMBER OF ILLITERATES AND THE NUMBER OF LITERATES

	A	B
Rate of demographic growth :	3%	3%
Initial illiteracy rate :	80%	80%
Literates' rate of increase :	10%	6%



Differential increase coefficient

The rate of increase of literates can be divided into two components:

1) one will have the same value as the population growth rate "r";

2) the other will represent the difference between the rate of increase of literates and the population growth rate.

The second factor, the differential increase coefficient, will be designated by "d" hereafter.

For instance, in the case of A and B,

where r = 0.03 = 3%, subsequently
for A, d = 0.10 - 0.03 = 0.07 or 7%,
and for B, d = 0.06 - 0.03 = 0.03 or 3%.

During this study we will see how essential it is to know this distribution of the rate of increase of literates in order to understand the evolutionary process in illiteracy.

2. Effect of the initial literacy rate

Let us try to detect the effects of the initial literacy rate on the stages of evolution in illiteracy. Graph 3 (page 27) represents the modifications in the number of literates in two countries. In both countries the population growth rate is 3% and the literacy rate is 40%, the illiteracy rate 60%. In one country (A) the rate of increase for literates is 10% and in the other (B) it is 6%.

In A, the number of illiterates starts decreasing in the first year already, and the 50% illiteracy rate is reached at the end of about four years.

In B, the number of illiterates first goes up slightly and then drops back to its starting level. The number decreases slowly, and the 50% rate is reached after eight years.

The evolution of illiteracy in these two countries is different from what could be observed if their literacy rate was 20% instead of 40% (illiteracy rate 80% and 60%).

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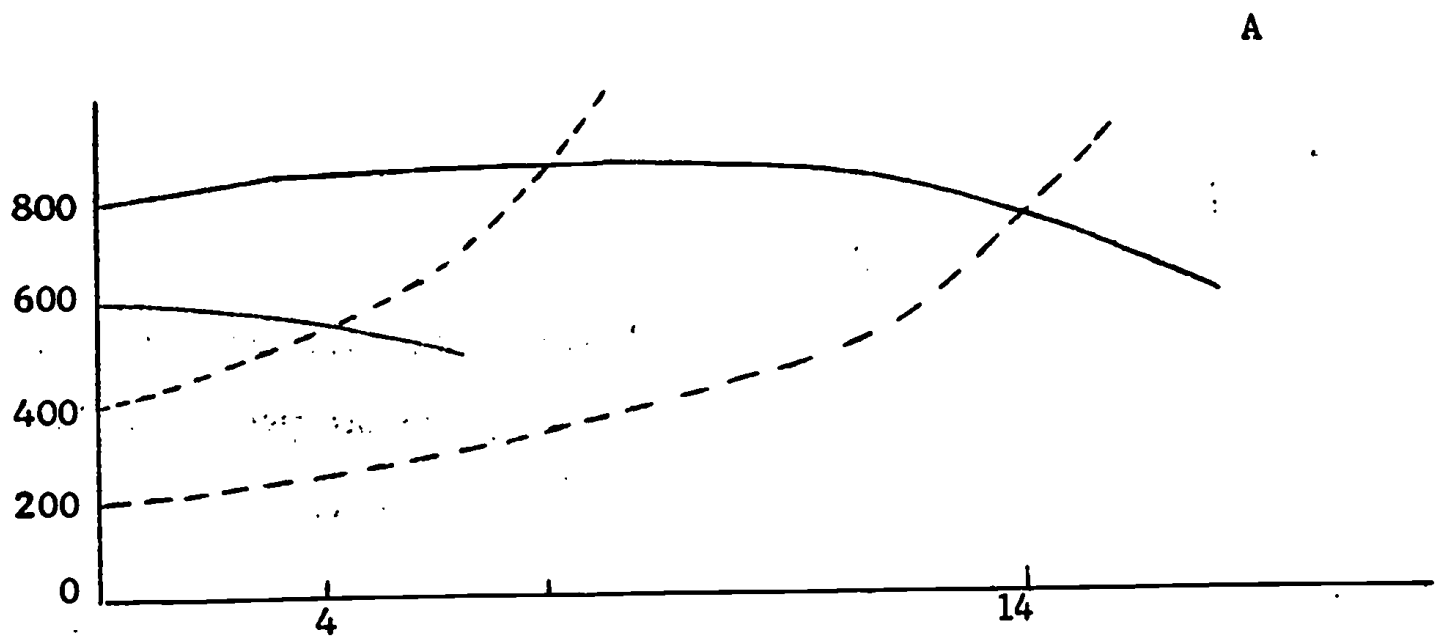
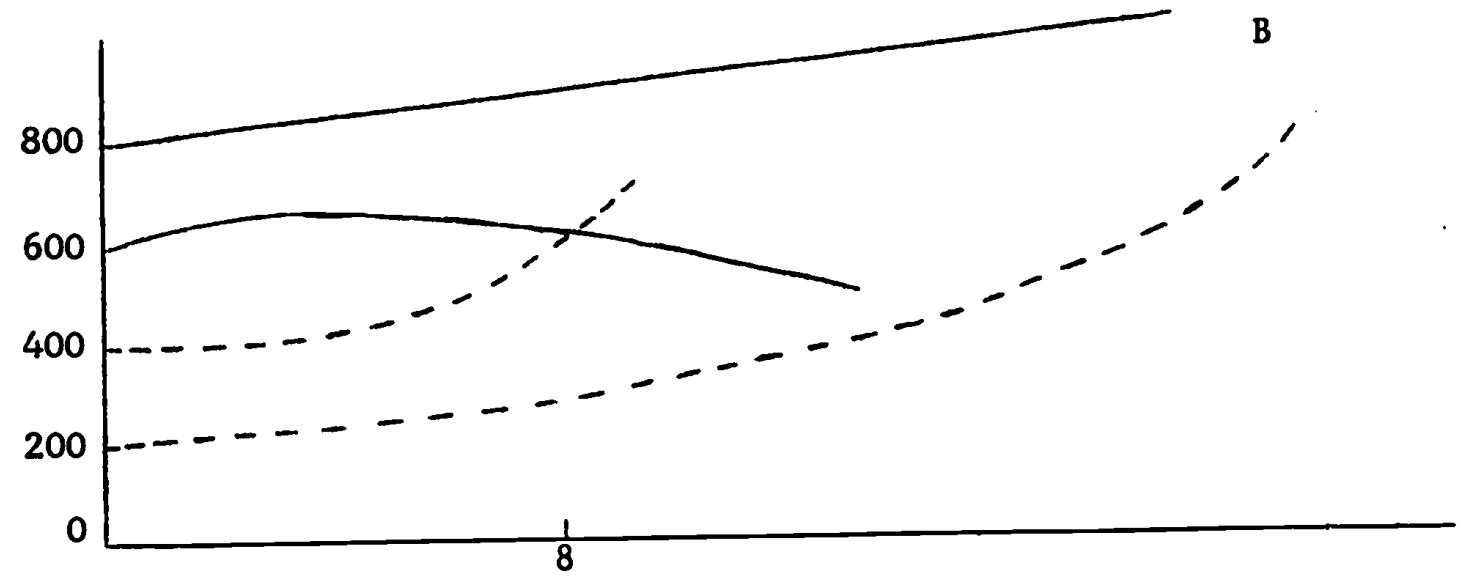


The differences are even more striking in the case of country B



We can conclude that not only does the growth rate of literates (and especially the differential increase coefficient) influence illiteracy trends in a country but that the value of the literacy rate is also a factor to be borne in mind when drawing up a country's illiteracy eradication programme.

3. The effects of the population growth rate

The two preceding graphs have shown the influence of the initial literacy rate and of the growth rate of literates on the trends in illiteracy.

(In the examples at hand the school system was considered to be the only channel to literacy which did not have a negligible result. Of course, the conclusions would not have been changed if the quantitative effects of "literacy campaigns" in illiteracy eradication had not been negligible.)

Let us examine the trends in illiteracy in two countries which initially have the same illiteracy rate (70%) and the same differential increase coefficient, d = 3%. In country A, the population growth rate is 2% and in country B it is 3% (see Graph 4, page 28).

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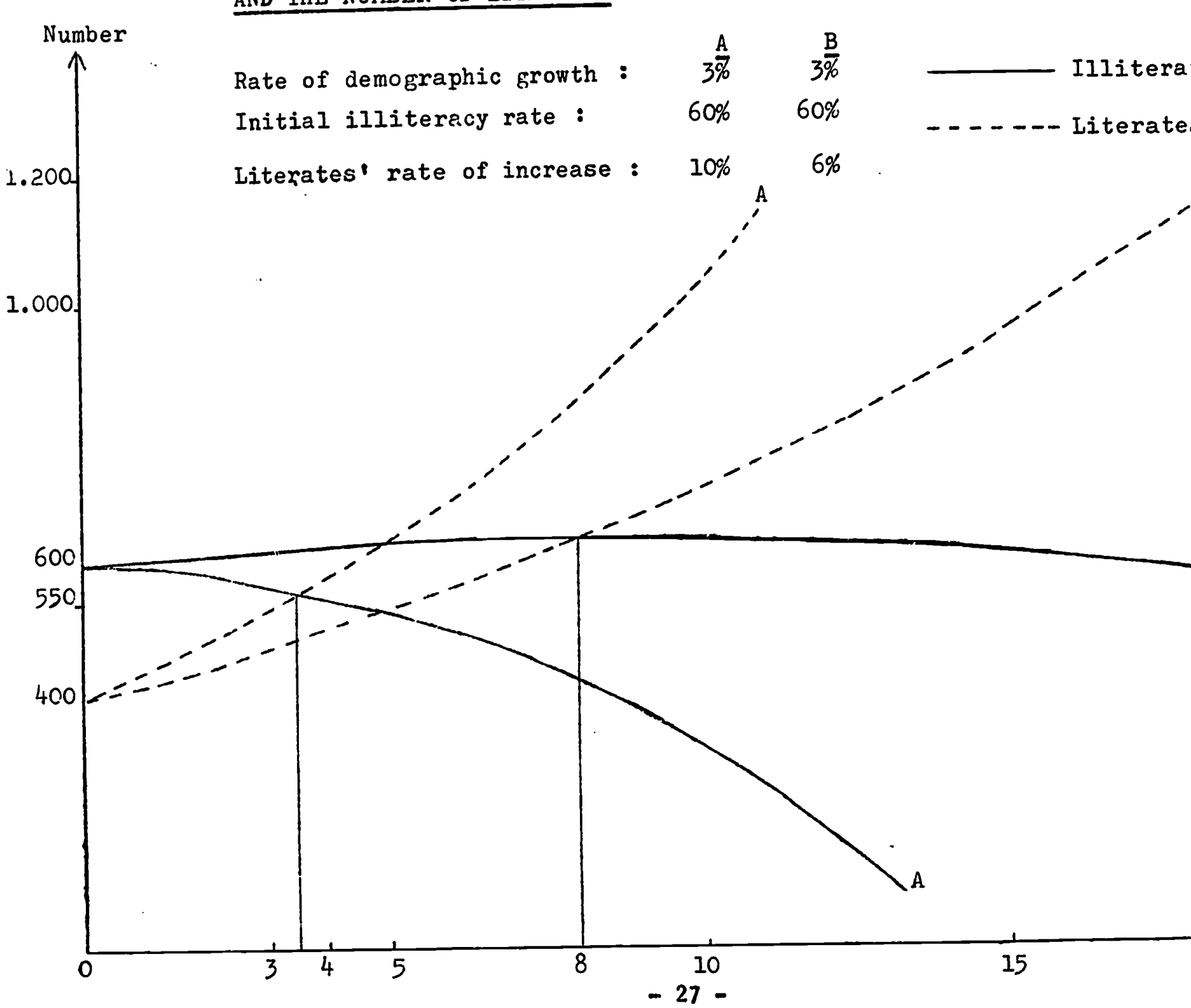
EVOLUTION OF THE NUMBER OF ILLITERATES AND THE NUMBER OF LITERATES



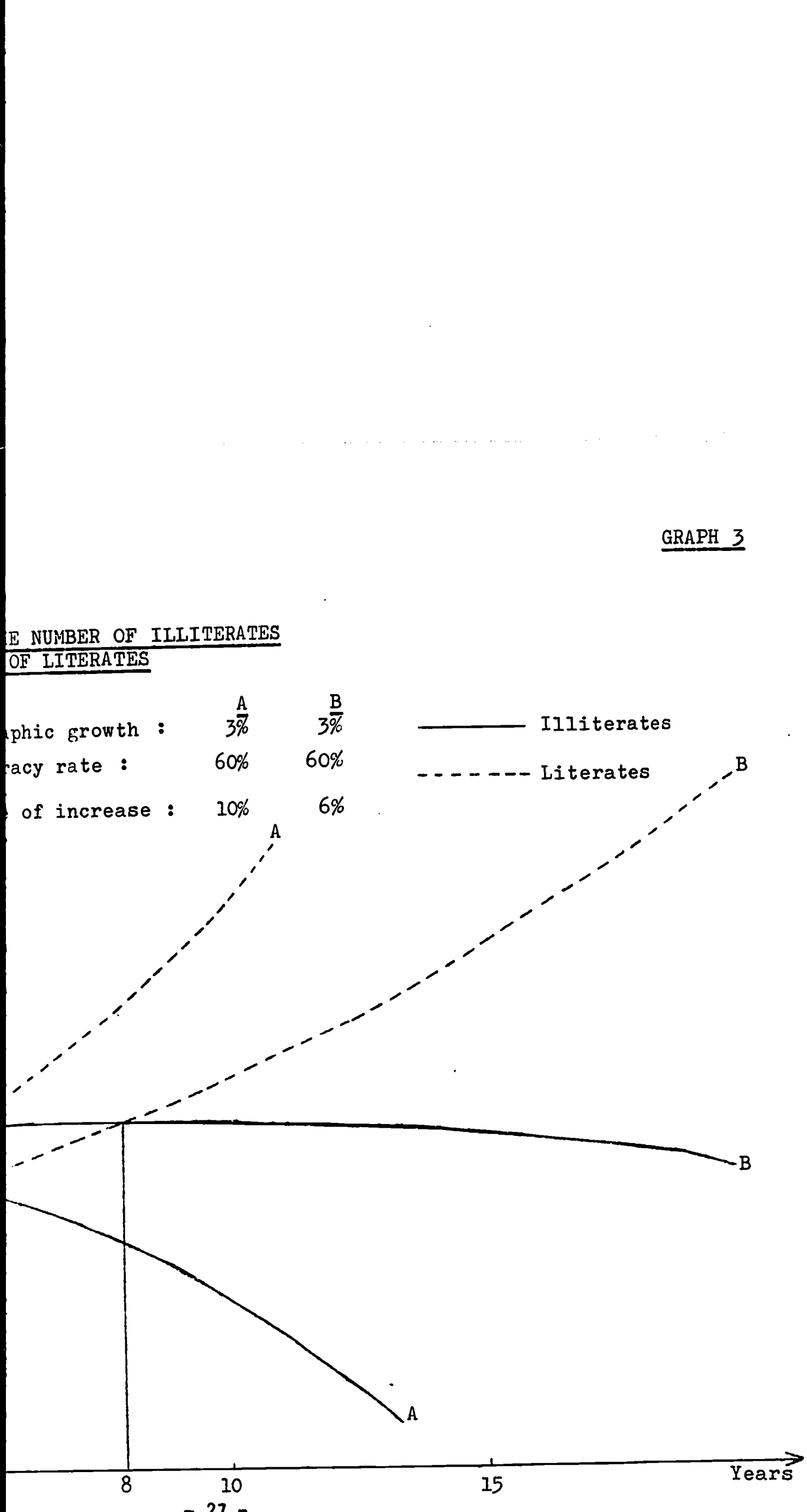
GRAPH 3

E NUMBER OF ILLITERATES
OF LITERATES

	A	B
phic growth :	3%	3%
racy rate :	60%	60%
of increase :	10%	6%

———— Illiterates

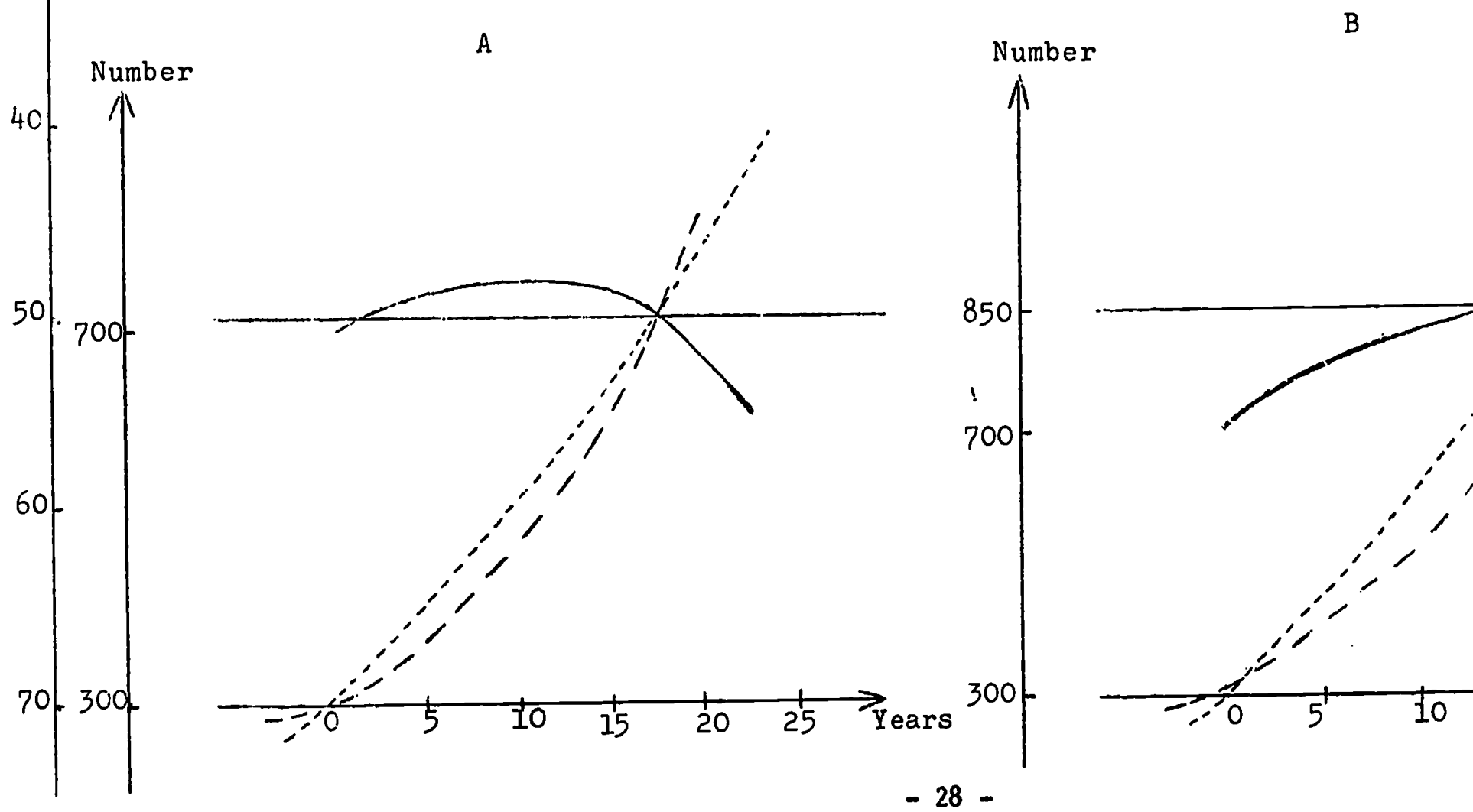
- - - - - - - Literates



FROM 70% AS ILLITERACY RATE TO 50%

	A	B
Rate of demographic growth	2 %	3 %
Literates' rate of increase	5 %	6 %

——— Illiterates
— — — Literates
------- Differential



GRAPH 4

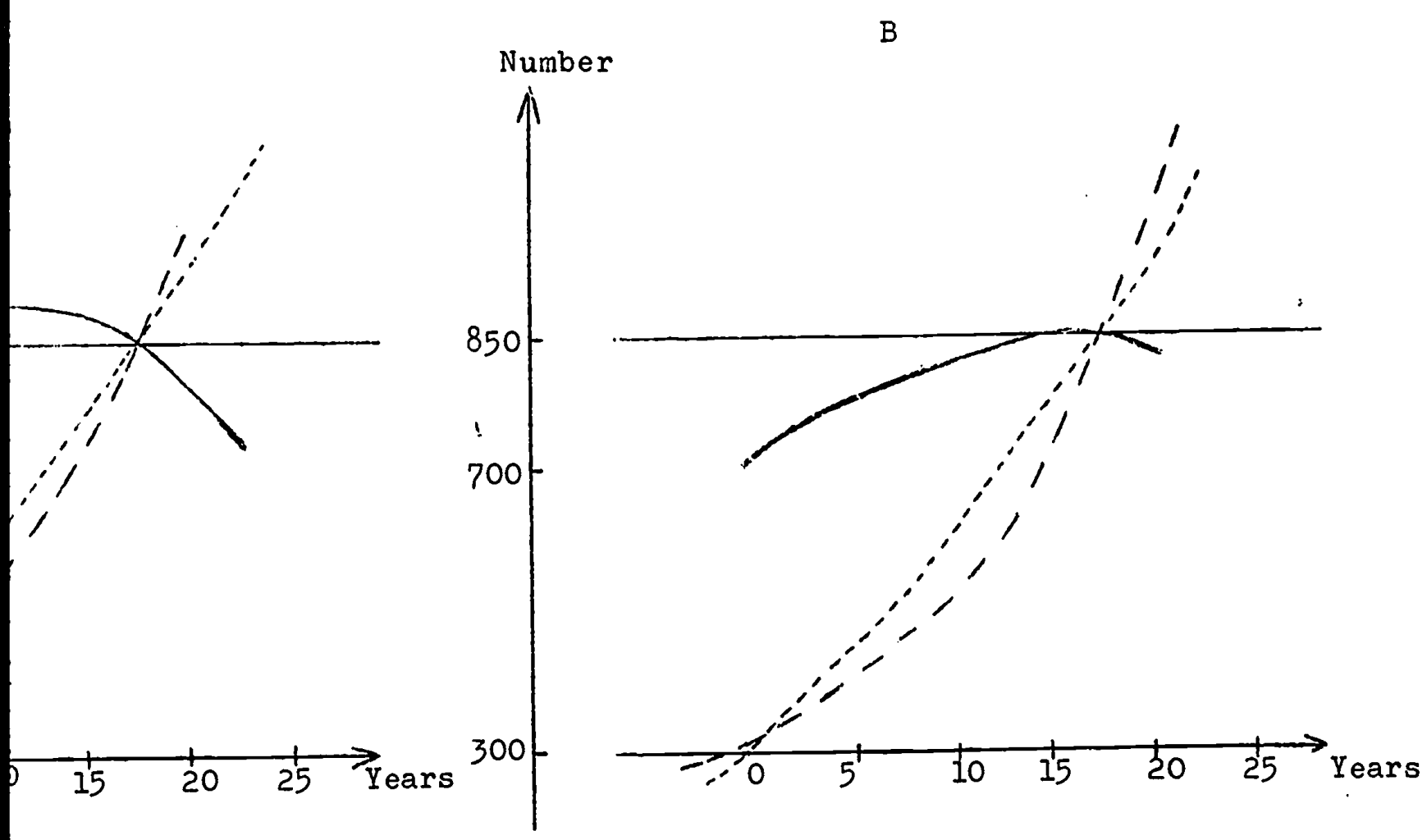
ILLITERACY RATE TO 50%

	A	B
nic growth	2 %	3 %
f increase	5 %	6 %

——— Illiterates

— — — Literates

------- Differential increase coefficient (d)



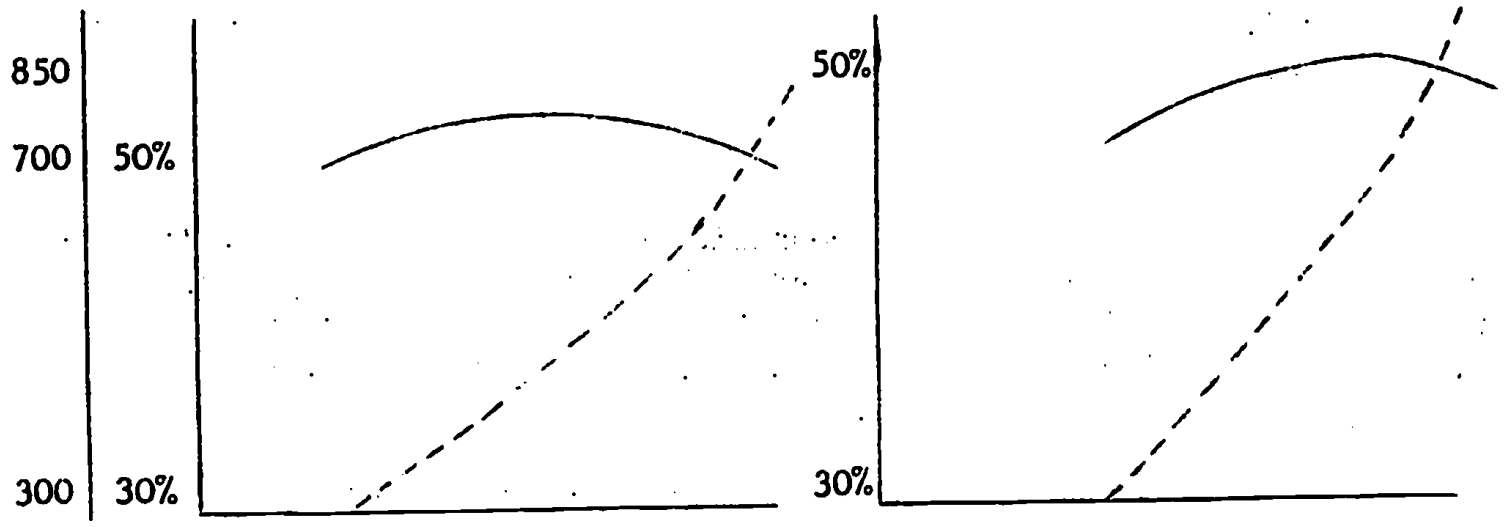
In both cases, the curve representing the differential increase coefficient dissects the two other curves (the curve representing the number of illiterates and the curve representing the number of literates) at the same point, i.e. after 17-18 years, when the literacy rate is 50%. So the two countries reach a 50% illiteracy rate after the same length of time (influence of the differential increase coefficient).

The differences show up in the manner in which the number of illiterates changes.

In A, the number of literates will increase during the first ten years with the maximum climb being around 4%. When the literacy rate reaches 50% the number of illiterates will only be 1% greater than the initial number.

In B, the increase in the number of illiterates will continue during the first sixteen years with the first drop taking place at the same date that the illiteracy rate attains the 50% mark. As Graph 4 shows, in B the increase in the number of illiterates is greater than in A. In A, the increase was equivalent to 4% of the initial 700, while in B the increase finally reached 21% of the initial number.

The following diagrams, at different scales, show the variations in the increase of the number of illiterates.



These graphs show that the number of illiterates does not change along the same pattern as the illiteracy rate, and that when studying trends in the numbers of illiterates, the population growth rate is a parameter not to be neglected.

4. Combined influence of the various factors

According to the conclusions drawn by examining trends in illiteracy, based on various assumptions, we find that the rate of increase for literates, and especially the part called the "differential increase coefficient", as well as the initial literacy rate, have an effect on the development of the illiteracy rate. Furthermore, the variations in the number of illiterates is related to the population growth rate.

.../...

During the study, the connection between the decrease in the illiteracy rate with the differential increase coefficient and the initial literacy rates will be examined.

As concerns the number of illiterates, we will provide some figures which show that there is a connection between the quantitative evolution of illiterates and the value of the population growth rate.

Let us take two countries that have the same population growth rate, and where the number of literates increases by 9% each year.

In country A, the illiteracy rate at the outset amounts to 70% of the population, and in B, 80%.

With such information available the number of illiterates in country A will start going down after two years, while in B this decrease will only start at the end of nine years.

So we see how influential the initial rate is.

Now, let us take three countries which initially have the same 80% illiteracy rate and 3% population growth rate. The rate of increase for literates differs from country to country : for A, 10%, for B, 9% and for C, 6%. The number of illiterates will start declining at the end of 7 years in A, at the end of 9 years in B, but not before 30 years have passed in C.

This shows us the influence of the rate of increase of literates.

Now, let us consider four countries having the same 70% illiteracy rate at the outset. Three, A, B and C, have the same 3% population growth rate, while in the fourth country the population growth rate is 2%. The rate of increasefor literates differs from country to country : 9% in A, 7% in B, 6% in C and D.

What progression will the number of illiterates follow in these countries ?

In A, the decrease will start at the end of 2 years,
In B, the decrease will start at the end of 11 years,
In C, the decrease will start at the end of 17 years, and
In D, the decrease will start immediately.

So we see the unmistakable effect of the population growth rate.

We could increase the number of examples by changing only one factor in each case.

Let us remember that the number of illiterates does not change along the same lines as the illiteracy rate and that the former is connected more closely to the variable - the population growth rate - than the latter.

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5. Effects of past developments

In the cases above, no consideration was given to the differences in the illiteracy rates per age group concerned. These differences can give some indication of the illiteracy and literacy trends in the past.

In developing countries, the youngest age groups have an illiteracy rate which is lower than that of the same age group in the preceding generation. In some cases these rate differences are considerable; this applies when the average annual rate of increase in the school enrolment in primary education is sharp, for instance, let us say, 10% in ten years. If we want to have an idea of the recent trends in the literacy rate we only need to examine the rate differences between the 10 year and older group and the 15 year and older group.

For instance, for Dahomeyan boys there is a four percent difference (84% for age 10 and over, 88% for age 15 and over). In Ivory Coast, though, the difference is 10% (82% for the 10 year and over group, 92% for the 15 year and over group). This is the result of more ample schooling in Ivory Coast than in Dahomey.

Between 1950 and 1961, for instance, the average annual rate of increase in primary school enrolment was 10% in Dahomey and 21% in Ivory Coast. In the 10 to 14 year age group, the illiteracy rate in Dahomey is 62% and in Ivory Coast 33%. For the age group over 10 to 14 years, the illiteracy rate is higher in Ivory Coast than in Dahomey.

We could also compare the rates for various age groups from Ivory Coast and Dahomey with those of Tanzania, where boys over 10 have the same illiteracy rate as in Ivory Coast : 82%.

In Tanzania, the schooling process in recent years has been the same as in Dahomey, but literacy training through schools and through literacy campaigns has been more uniformly provided in Tanzania than in Ivory Coast.

By examining from the following table for 1962, we clearly see that if we apply the same growth rates for literates in these four countries we will not have exactly the same decrease in the illiteracy rates because the per age group illiteracy rates differ.

Country	Illiteracy rates, for males, per age group								
	10+	15+	10-14	15-19	20-24	25-34	35-44	45-54	55-64
Cameroon	60	69	13	24	43	75	90	97	99
Ghana	62	71	21	28	53	75	87	96	98
Kenya	57	70	22	45	48	61	73	85	92
Zambia	64	65	54	57	61	63	67	75	80

Therefore, it is necessary to add the adjustment factor, which applies to influences stemming from past trends, to the other factors already mentioned.

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CHAPTER II - MEASURING PROGRESS

1. A 50% literacy rate

The literacy rate reaches 50% when the number of illiterates or of literates is equal to half the population.

So,

P_{to} a population of 10 years and older, in t_o

α_o the literacy rate, in t_o

$P_{to}(\alpha_o)$ the number of literates in t_o

r the population growth rate

$r + d$ the rate of increase for literates

When the literacy rate reaches 50%, we have :

$$\text{The number of literates} = \frac{\text{the population (literates + illiterates)}}{2}$$

In any given country, the initial literacy rate and the population growth rate are basic data. In order to find out the number of years required to reach a 50% level, when r + d are known, a value which fits into the equation has to be found for n.

In tn, we have :

$$P_{to}\,\alpha_o\,(1 + r + d)^n = \frac{P_{to}\,(1 + r)^n}{2}$$

$$\frac{(1 + r + d)^n}{(1 + r)^n} = \frac{1}{2\,\alpha_o}$$

Using this equation, we can also find d when n is known.

Example :

A country with an 85% illiteracy rate or 15% literacy rate and a 3% population growth rate wants to know how many years it will take to reach a 50% literacy rate. The average rate of increase for the number of literates is 8% per year.

The given information then is :

.../...

$$r = 3\% = 0.03$$
$$r + d = 8\% = 0.08$$
$$d_c = 15\% = 0.15$$

Therefore :

$$\frac{(1 + 0.08)n}{(1 + 0.03)n} = \frac{1}{0.15 \times 2} = \frac{1}{0.30}$$

It is a matter of finding n, so :

$$(1.05)^n = 3.33$$

By looking in the 5.00 column of the appended table we see that the u^n value which is closest to 3.33 is 3.39. The value for n can be read in the "n column" on the horizontal which corresponds to 3.39; here we have 25.

The answer to the question is 25 years.

The same country could have set a time limit, let us say 10 years. In that case it would like to know the average annual rate of increase which should be applied to the number of literates.

Two methods of calculating can be derived from the following formula :

$$\frac{(1 + r + d)^n}{(1 + r)^n} = \frac{1}{2 d_c}$$

First method

$$\frac{(1 + r + d)^{10}}{(1 + 0.03)^{10}} = \frac{1}{0.30} = 3.33$$

The table shows that the u^n value for i = 0.03 (or i% = 3.00) when n is 10 :

$$(1 + 0.03)^n = 1.34$$

Therefore :

$$(1 + r + d)^{10} = 3.33 \times 1.34 = 4.46$$

.../...

By looking at the table and following the horizontal column when n = 10, the value closest to 4.46 is :

4.41 in the 16.00 column.

This infers that the value is slightly above 16%.

So in this case the answer to the question would be : the average annual rate of increase of the number of literates is 16%.

Second method

$$\frac{(1 + r + d)^n}{(1 + r)^n} = \frac{1}{2 Q_o}$$

This can be written :

$$(1 + d)n = \frac{1}{2 Q_o}$$

or :

$$(1 + d)^{10} = \frac{1}{0.30} = 3.33$$

Look at the table and follow the horizontal line when n = 10 to find the value which is closest to 3.33 : i% = 13, which corresponds to the value of d.

The rate of increase for the number of literates (r + d) will, then, be equal to :

3% + 13% = 16%

So if we know the population growth rate and the literacy rate we can calculate d or n (the other being a fixed figure) in order to reach a 50% literacy rate.

The same calculations can be used regardless of the literacy rate under consideration.(1) The ½ (or 0.50) need only be replaced by the literacy rate that one wants to reach.

For instance, if the target is a 30% literacy rate, instead of ½, that is to say 0.50 literacy rate, we will have 0.30 and the formula becomes :

$$\frac{(1 + r + d)n}{(1 + r)^n} = 0.30 \times \frac{1}{\alpha_o} = \frac{0.30}{\alpha_o}$$

.../...

(1) See pages 39 and following.

2. Measuring the illiteracy rate according to the value of the differential increase coefficient

Graph 5 (page 36) shows seven curves for the differential increase coefficient when :

$$d = 1\% \ (0.01) \text{ up to } d = 7\% \ (0.07).$$

It establishes a relationship between the value of the illiteracy rate (from 90% to 0%) and the number of years required to progress from one rate to another.

Through these curves, then, when we know both d and the period during which the differential increase coefficient applies, the value of the illiteracy rate can be determined.

When the illiteracy rates are known, these curves can also be used to find either d or n (number of years).

For instance, in 1962 a country had a 90% illiteracy rate. The rate of increase for the number of literates is estimated at 6%. If we know that the annual population growth rate is 2%, how can we find the illiteracy rate for this country in 1972?

d = increase rate for the number of literates minus the population growth rate

$$d = 0.06 - 0.02 = 0.04 = 4\%.$$

Since 1962 was the starting year (point 0), 1972 will be year 10.

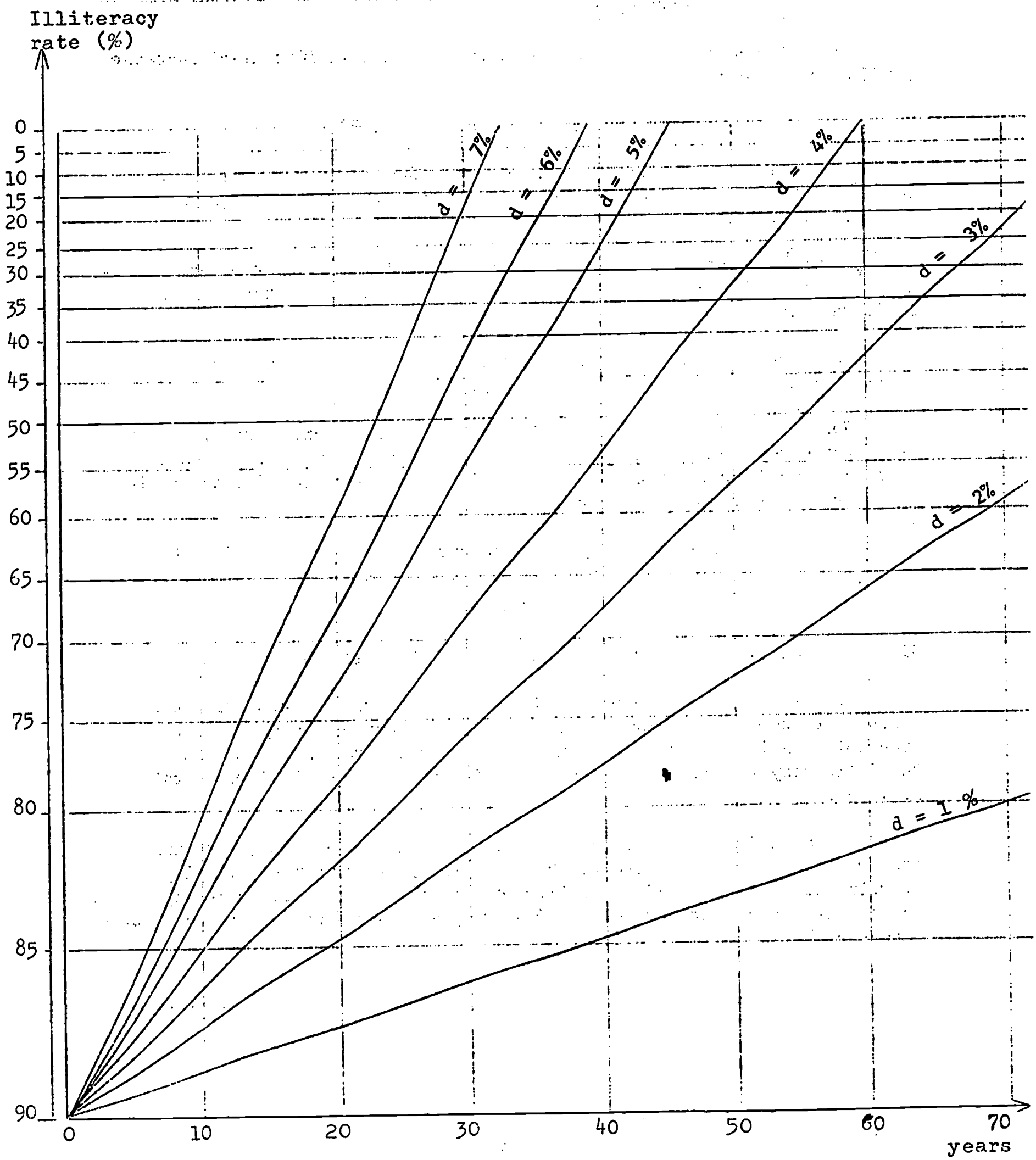
From 10, draw a line perpendicular to the axis representing the years up to the point where it meets the d = 4 curve. From the intersection point, a line parallel to the years' axis is drawn. This line cuts the illiteracy percentage axis giving the value of the illiteracy rate, i.e. 85%.

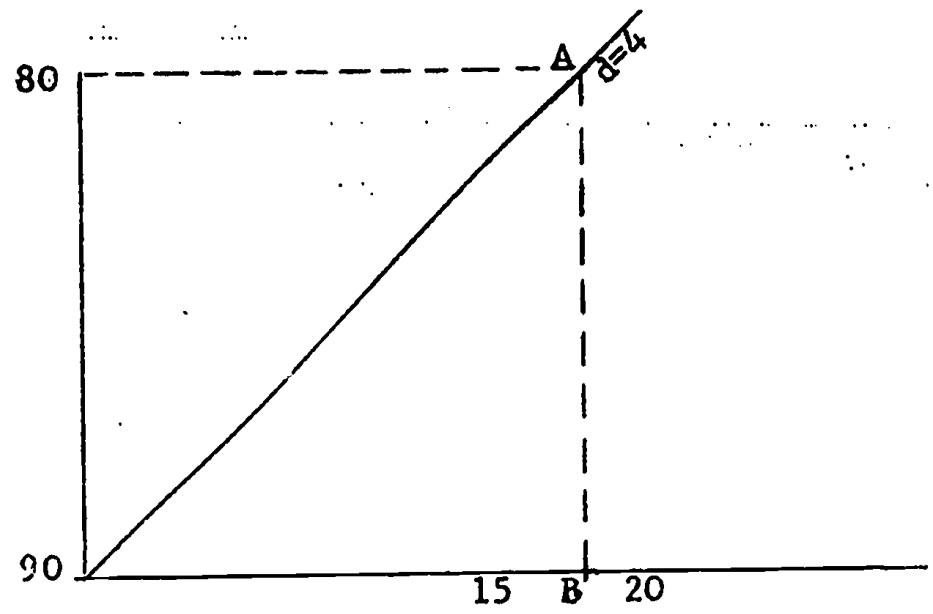
If the initial illiteracy rate was 80% instead of 90%, the first step would have been to situate the year 1962. In order to do this, starting at 80, draw a line parallel to the abscissa; from point A, where the parallel line crosses the d = 4 curve, a perpendicular line is dropped onto the abscissa.

.../...

GRAPH 5

DIFFERENTIAL INCREASE COEFFICIENT (d)





This perpendicular drops to point B which gives the point to be considered as the starting year, that is, 1962.

In order to find this country's illiteracy rate in 1972 count ten years, starting from B and proceed as above.

Now let us assume that we want to find out what rate of increase to choose for measuring the number of illiterates. We know that :

- the population growth rate is 2.5%
- the target is to progress from 80% illiteracy rate to 70% in ten years.

Starting from 80 and from 70 we draw two lines which are parallel to the axis of the abscissas. These parallels intersect the various curves. The curve chosen is the one upon which the distance between the two parallel line/curve intersection points represent 10 years.

None of the curves meet these conditions. Therefore an additional curve has to be drawn between 5 and 4, closer to 4 than to 5. This infers that d = 4.3.

The rate of increase for the number of literates should be 4.3 + 2.5 = 6.8, or about 7%.

We have used the preceding graph to draw up the following table which gives the number of years needed to decrease the illiteracy rates (shown in 10% groups). The differential increase coefficient was known.

.../...

Estimated number of years needed to decrease the illiteracy rate according to the value of the differential increase coefficient and the value of the illiteracy rate.

Value of the differential increase coefficient	Number of years needed to bring about a 10% decrease in the illiteracy rate according to the value of the initial rate							
	90% to 80%	80% to 70%	70% to 60%	60% to 50%	50% to 40%	40% to 30%	30% to 20%	20% to 10%
0.01	70	43	30	23	18	16	14	12
0.02	35	21	15	12	9	8	7	6
0.03	24	14	10	8	6	6	5	4
0.04	18	11	7	6	5	4	4	3
0.05	14	9	6	5	4	3	3	2
0.06	12	7	5	4	3	3	2	2
0.07	10	6	4	4	3	2	2	2

These estimations were read off the graph.

We have noted that when d is given,

- It takes twice as long to progress from 90 to 70% (20% decrease) than to progress from 80 to 50% (30% decrease);
- It takes just as long to progress from 90 to 80% (10% decrease) as from 80 to 60% (20% decrease);
- It takes just as long to progress from 90 to 70% (20% decrease) as from 70 to 10% (60% decrease).

We have noted that when the decrease rate is fixed,

- It takes twice as long if d = 3% than if d = 6%;
- It takes three times as long if d = 2% than if d = 6%.

We have noted that :

- It takes just as long to progress from 90 to 80% when d = 3% than it takes to progress from 90 to 60% when d = 6%, or from 90 to 50% when d = 7%.

In conclusion,

- The decrease in the illiteracy rate (or increase in the literacy rate),
- The number of years needed to bring about this decrease (or this increase),
- The value of the differential increase coefficient,

are closely related. It would be dangerous to carry out an illiteracy

.../...

eradication programme using one of these factors without having examined the other two and their reciprocal effects.

3. The differential increase coefficient and the number of years needed to reach a fixed target in terms of the literacy rate

When an illiteracy rate changes from 80% to 60% this means that the literacy rate has climbed from 20% to 40%.

If α_o represents the initial literacy rate, the pool of literates in t_o will be $P_{to}\ \alpha_o$ if the total population for that age group is P_{to} and $\alpha_o = \frac{P_{to} \times \alpha_o}{P_{to}}$

Since we know that the rate of increase for the number of literates is equal to r + d and that the population growth rate is r, in t_n, we know that the total population will be equal to $P_{to}\ (1 + r)^n$ and that the population of literates will be equal to $P_{to}\ \alpha_o\ (1 + r + d)^n$.

In t_n, the literacy rate α_n, then, will be :

$$\alpha_n = \frac{P_{to}\ \alpha_o\ (1 + r + d)^n}{P_{to}\ (1 + r)^n}$$

and :

$$\alpha_n = \alpha_o\ \frac{(1 + r + d)^n}{(1 + r)^n} \nearrow \alpha_o\ (1 + d)^n$$

By stating that :

$$\frac{\alpha_n}{\alpha_o} = a = \frac{\text{the literacy rate "at the end"}}{\text{the "initial" literacy rate}}$$

we see that :

$$\frac{\alpha_n}{\alpha_o} = a = (1 + d)^n$$

and we can write that :

$$\log a = n \log (1 + d)$$

For several different values of a, curves can be worked out which relate n (n being the number of years needed to reach a certain literacy rate "in the end") to log (1 + d) (d being the differential increase coefficient mentioned above). The curves on graph 6 (page 41) show eleven different values for a and the corresponding n and d values.

A country wants its literacy rate to go from 10% up to 20% and wants to know what average annual growth rate its school system will require, the schools being the only source of literacy training.

.../...

First, the value of a must be calculated :

$$a = \frac{\alpha_n}{\alpha_o}\text{ ; in this particular case, } a = \frac{20}{10} = 2$$

We can find the rate of increase for the number of literates by adding the population growth rate to the differential increase coefficient. So the next step is to find the value of the differential increase coefficient. In order to look for this value we must take our bearings on the a = 2 curve.

We could assign many different values to d, but the value of n will depend on the value selected for d, that is, the number of years needed to reach the objective.

For instance :

if d = 9, n will equal 8
if d = 8, n will equal 9
if d = 5, n will equal 14, etc.

The values of d and n may be coupled in many ways, but not all of them are of the same interest to the country.

Financial restrictions, classroom capacity, teaching personnel, time, etc. all provide data which make it possible to choose the d and n values from amongst those given on the a = 2 curve.

However, if one of the values, d or n, is fixed at the outset, the other automatically follows on the curve; no choice is left.

So in the example at hand, we could not say that d = 8% and then say that the 20% literacy aim will be reached in five years (n = 5). We see that if d = 8%, on the a = 2 curve n is 9.

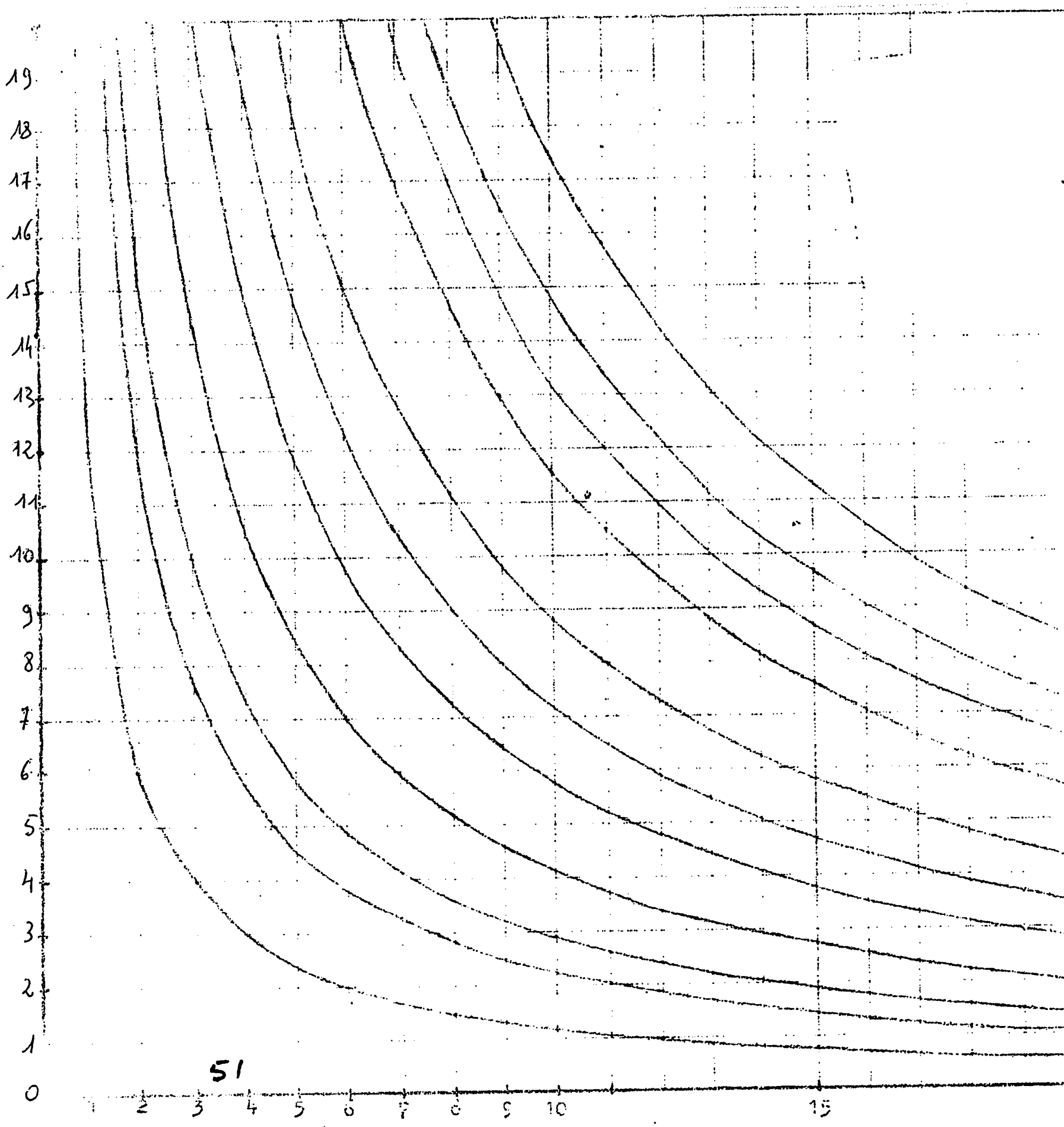
In order to reach the target in five years, we must consider a differential increase coefficient of 15%.

The definitive answer to what growth rate should be assigned to a school system depends on :

1. The time period in which the target is to be reached,
2. The population growth rate,
3. The ratio between the number of literates per school and the initial "stock" of literates,
4. The relation between the rate of increase for school trained literates and the growth rate of the school system.

The distinction made in point 4 between the rate of increase for the number of school trained literates and the growth rate of the school system

.../...


19
18
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15

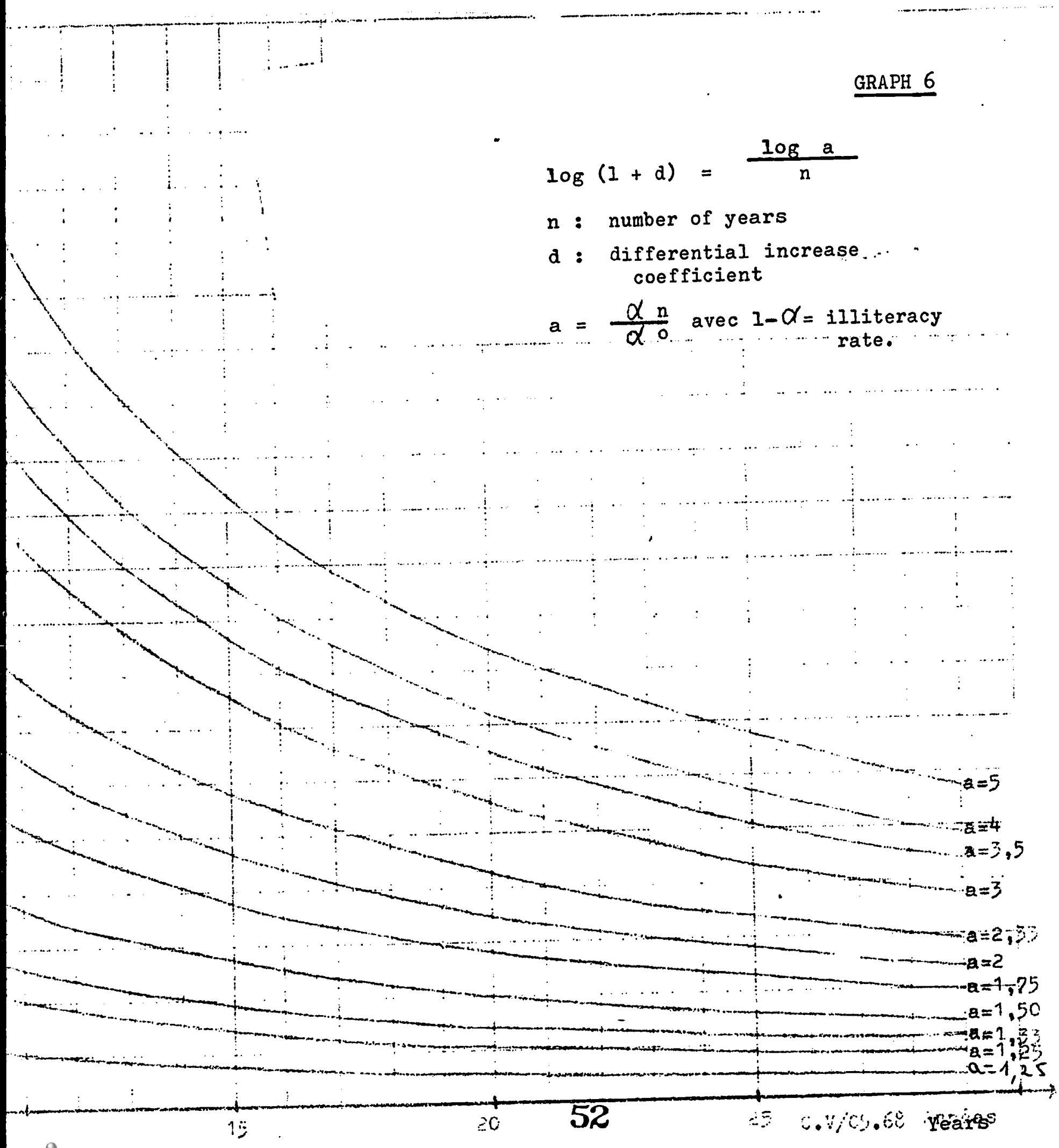
GRAPH 6

$$\log (1 + d) = \frac{\log a}{n}$$

n : number of years

d : differential increase coefficient

$a = \frac{\alpha n}{\alpha o}$ avec $1-\alpha$ = illiteracy rate.



results from the manner in which the school system is presently run. The increase in the number of pupils in primary education is too often due to the high enrolment - in the first year of primary schools - of pupils who do not even reach the fourth form [1] or who, more and more, repeat a form once or even twice. So the number of literates may increase by 5% per year while the total number of pupils in primary school, because of defects in the way the system operates, will increase by 8, 10 or even 15%.

The indications provided by the a = 2 curve apply just as well when progress is to be made from 10 to 20% or from 15 to 30% or from 20 to 40%, since in each case a = 2.

We see that :

$$\frac{\alpha_n}{\alpha_o} = \frac{30}{15} = 2$$

$$= \frac{40}{20} = 2$$

A country which wants to progress from 10 to 40% would follow the a = 4 curve, since

$$\frac{\alpha_n}{\alpha_o} = \frac{40}{10} = 4$$

To find out the possible values for d and for n when progress from 30 to 40% is to be made, the a = 1.33 curve must be used :

$$\frac{\alpha_n}{\alpha_o} = \frac{40}{30} = 1.33$$

It should be observed that all the curves for the a value do not appear on the graph, and the lengths for the eleven curves, in certain cases, may be too short to solve a given problem. In such cases the answers can be found by using the formula log a = n log (1+d) directly or, on the basis of the remarks made on page 38 by working out a simple multiplication using the table on the same page, or by using a pair of values given by the a curve.

As an example let us take a country which wants to increase its literacy rate from 10 up to 35% (or to decrease its illiteracy rate from 90 to 65%) in a period of five years. The value of the differential increase coefficient must be found. The value of a is 3.5.

.../...

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(1) See Part One.

$$a = \frac{\alpha_n}{\alpha_o} = \frac{35}{10} = 3.5$$

Taking the equation :

$$\log a = n \log (1+d),$$

we find that the value of the differential increase coefficient is 28%.

Taking a reading on graph 6 at any point on the a = 3.5 curve, let us say d = 11% and n = 12, and then dividing the product of d x n by the given time period, that is, five years, we obtain a quotient which is close to the differential increase coefficient :

$$\frac{d\ n}{5} = \frac{132}{5} = 26.4$$

Using the table on page 37 & 38 & the remarks on page 38, we will see that it is preferable to take a 0.05 value(1) for the differential increase coefficient. Taking this value, in order to progress from 10 to 35%, we then calculate :

$$15 + 9 + \frac{6}{2} = 27$$

$$\frac{0.05 \times 27}{5} = 0.27 = 27\%$$

The solution, then, is 27% for the differential increase coefficient.

4. Decreasing the number of illiterates

The number of illiterates is equal to the population (P) minus the number of literates ($P\alpha$).

If the number of illiterates decreases, the number of illiterates in t_n will be smaller than the number of illiterates in t_{n-1}.

This can be shown by the following inequality :

$$P_{tn} - P\alpha_{tn} < P_{tn-1} - P\alpha_{tn-1}$$

If the average annual population growth rate is r and the rate of increase for the number of literates is equal to r + d, we can state that :

.../...

(1) To simplify the calculation.

$$P_{to}(1+r)^n - P_{to}\,\alpha_o(1+r+d)^n < P_{to}(1+r)^{n-1} - P_{to}\,\alpha_o(1+r+d)^{n-1}$$

$$\frac{1}{\alpha_o} < \frac{(1+r+d)^{n-1}}{(1+r)^{n-1}} \cdot \frac{r+d}{r}$$

Using this formula, when r and d are known, n can be calculated.

Example :

In the beginning a country has a literacy rate of 20% (an illiteracy rate of 80%). The natural annual population growth rate is 3%. The average annual rate of increase for the number of literates is 10%.

After how many years can this country hope to see the number of illiterates decrease, assuming that the above rates, except, naturally, the above literacy rate, are maintained?

The inequality :

$$\frac{1}{\alpha_o} < \frac{(1+r+d)^{n-1}}{(1+r)^{n-1}} \cdot \frac{r+d}{r}$$

becomes :

$$\frac{1}{0.20} < \frac{(1+0.10)^{n-1}}{(1+0.03)^{n-1}} \cdot \frac{0.10}{0.03}$$

$$5 < (1+0.07)^{n-1} \times 3.33$$

The number of illiterates will decline when :

$$(1+0.07)^{n-1} > \frac{5}{3.33}$$

$$(1+0.07)^{n-1} > 1.50$$

In the 7% column of the appended table, we look for the u^n value which is equal to or greater than 1.50. 1.50 is found in the horizontal column starting from 6, so we have the value for n - 1.

$$n - 1 = 6, \text{ so } n = 7$$

We can therefore infer that the number of illiterates will decrease as from the eighth year.

We have just examined the case in which the number of illiterates will start to drop at the end of n years.

The basic information would be different if we wanted the number of illiterates to decrease from one year to the next, so not only would :

$$P_{to}(1+r)^n - P_{to}\,\alpha_o(1+r+d)^n < P_{to}(1+r)^{n-1} - P_{to}\,\alpha_o(1+r+d)^{n-1}$$

.../...

but also :

$$P_{to}\,(1+r) - P_{to}\,\alpha_o\,(1+r+d) < P_{to} - P_{to}\,\alpha_o$$

In this case,

$$\alpha\,(r+d) > r.$$

$$\text{or} \quad r+d > \frac{r}{\alpha}$$

If we want the number of illiterates to decrease from one year to the next, the rate of increase for the number of literates must be higher than the result of the population growth rate divided by the literacy rate of the previous year.

In conclusion, we can say that :

The essential factor influencing the progression of the literacy rate is the differential increase coefficient. But as concerns the evolution of the number of illiterates (not the illiteracy rate), the effect of the population growth rate must also be taken into consideration.

C O N C L U S I O N

We might ask ourselves what the use is of measuring the developments in literacy in this manner, taking into account the yields from the school system.

It allows us to evaluate the effort needed to attain a target in literacy and to formulate strategies which our resources can underwrite.

The scope of this effort and the means to be put to use and, finally, the strategy to be used in the campaign against illiteracy differ, depending on whether the literacy rate is to be increased or whether a certain number of people are to be made literate.

1. The target can be expressed in terms of literacy rates.

Throughout Part Two, we saw that by using graph 6 we could determine the average annual rate of increase for the number of literates needed to ensure that at the end of a given period of time the percentage of literates in the whole population (in the 10 year and over age group, for instance) would correspond to the objectives set down.

The difference between the end number of literates and the initial number only provides a rough indication of the scope of the literacy campaign needed in order to reach the target, and does not indicate how many persons are to become literate during that period.

In actual fact, we must, on the one hand, bear in mind the annual decrease in the initial pool of literates - mainly due to deaths - and, on the other, the input from the school system into the stock of literates.

The size of the literacy campaign, finally, will be determined by the result of the following operation. When the value of the final number of literates has been settled, we must :

i) subtract the initial number of literates,

ii) subtract the school trained literates,

iii) add the number of literates who died between the beginning and the end of the period.

Point ii) can be calculated by extrapolating trends from the school system; and a calculation on the yield from the school system could encourage one to question its functioning.

.../...

Will trends of past years continue? Should they? Is a quantitative improvement of the school yield necessary? etc.

Point iii) will not only be contingent on the literacy rates of the various age groups in the beginning but also on the age of the people made literate during the campaign. The survival coefficient depends on the age. The difference may be negligible for a five-year period but this will not hold true for a decade. In order to have a given number of literates at the end of a decade, a greater number must be taught if the age group is the 45 year and older group than if the age group is 20 to 35.

We see how important the selectivity factor is then in literacy campaigns, not only for economic reasons - in order to integrate literacy campaigns in economic development projects - but also because of the demographic criteria which implies a qualitative selection of future literates.

In a functional, selective literacy campaign, it is the tactics which should be selective and the educational approach which should be functional.

One must note that the annual number of persons to be made literate cannot be obtained by dividing the total pool for the period by the number of years which compose this period.

The sailing speed cannot always be reached during the first year. Furthermore, inculcating adequate literacy usually requires more than a year.

Scheduling literacy training is also important.

2. The target can be expressed in terms of the number of persons to be made literate.

This second form of expression is used more often than the first, especially in the case of functional literacy.

For instance, it can be said that so many people are to be made literate during the functional, selective literacy campaign which has been integrated into an economic and social development project. The number of persons to be made literate, then, is fixed; what will be the effect of this campaign in eradicating the national society's illiteracy and, subsequently, can a significant result be obtained?

The arithmetical calculations will be carried out in an order which is inverse to the one used for calculating the target in terms of literacy rates.

The impact of the number of new literates on the literacy rate will often be slight, except in cases where the illiteracy rate is very high.

Quite clearly, calculations must be made before literacy campaigns are launched. Only through this very essential step can the general targets and the strategies needed to reach them become clear.

ANNEX

$$u^n = (1 + i)^n$$

n \ i%	1,00	2,00	3,00	4,00	5.00	6,00	7,00	8,00
1	1,01	1,02	1,03	1,04	1,05	1,06	1,07	1,08
2	1,02	1,04	1,06	1,08	1,10	1,12	1,14	1,17
3	1,03	1,06	1,09	1,12	1,16	1,19	1,23	1,26
4	1,04	1,08	1,13	1,17	1,22	1,26	1,31	1,36
5	1,05	1,10	1,16	1,22	1,28	1,34	1,40	1,47
6	1,06	1,13	1,19	1,27	1,34	1,42	1,50	1,59
7	1,07	1,15	1,23	1,32	1,41	1,50	1,61	1,71
8	1,08	1,17	1,27	1,37	1,48	1,59	1,72	1,85
9	1,09	1,20	1,30	1,42	1,55	1,69	1,84	2,00
10	1,10	1,22	1,34	1,48	1,63	1,79	1,97	2,16
11	1,12	1,24	1,38	1,54	1,71	1,90	2,10	2,33
12	1,13	1,27	1,43	1,60	1,80	2,01	2,25	2,52
13	1,14	1,29	1,47	1,67	1,89	2,13	2,41	2,72
14	1,15	1,32	1,51	1,73	1,98	2,26	2,58	2,94
15	1,16	1,35	1,56	1,80	2,08	2,49	2,76	3,17
16	1,17	1,37	1,60	1,87	2,18	2,54	2,95	3,43
17	1,18	1,40	1,65	1,95	2,29	2,69	3,16	3,70
18	1,20	1,43	1,70	2,03	2,41	2,85	3,38	4,00
19	1,21	1,46	1,75	2,11	2,53	3,03	3,62	4,32
20	1,22	1,49	1,81	2,19	2,65	3,21	3,87	4,66
21	1,23	1,52	1,86	2,28	2,79	3,40	4,14	5,03
22	1,24	1,55	1,92	2,37	2,93	3,60	4,43	5,44
23	1,26	1,58	1,97	2,46	3,07	3,82	4,74	5,87
24	1,27	1,61	2,03	2,56	3,23	4,05	5,07	6,34
25	1,28	1,64	2,09	2,67	3,39	4,29	5,43	6,85
26	1,30	1,67	2,16	2,77	3,56	4,55	5,81	7,40
27	1,31	1,71	2,22	2,88	3,73	4,82	6,21	7,99
28	1,32	1,74	2,29	3,00	3,92	5,11	6,65	8,63
29	1,33	1,78	2,36	3,12	4,12	5,42	7,11	9,32
30	1,35	1,81	2,43	3,24	4,32	5,74	7,61	10,06
31	1,36	1,85	2,50	3,37	4,54	6,09	8,15	10,87
32	1,37	1,88	2,58	3,51	4,76	6,45	8,72	11,74
33	1,39	1,92	2,65	3,65	5,00	6,84	9,33	12,68
34	1,40	1,96	2,73	3,79	5,25	7,25	9,98	13,69
35	1,42	2,00	2,81	3,95	5,52	7,69	10,68	14,79

n \ i%	9,00	10,00	11,00	12,00	13,00	14,00	15,00	16,00
1	1,09	1,10	1,11	1,12	1,13	1,14	1,15	1,16
2	1,19	1,21	1,23	1,25	1,28	1,30	1,32	1,35
3	1,30	1,33	1,37	1,40	1,44	1,48	1,52	1,56
4	1,41	1,46	1,52	1,57	1,63	1,69	1,75	1,81
5	1,54	1,61	1,69	1,76	1,84	1,93	2,01	2,10
6	1,68	1,77	1,87	1,97	2,08	2,19	2,31	2,44
7	1,83	1,95	2,08	2,21	2,35	2,50	2,66	2,83
8	2,00	2,14	2,30	2,48	2,66	2,85	3,06	3,28
9	2,17	2,36	2,56	2,77	3,00	3,25	3,52	3,80
10	2,37	2,59	2,84	3,11	3,39	3,71	4,05	4,41
11	2,58	2,85	3,15	3,48	3,84	4,23	4,65	5,12
12	2,81	3,14	3,50	3,90	4,33	4,82	5,35	5,94
13	3,07	3,45	3,88	4,36	4,90	5,49	6,15	6,89
14	3,34	3,80	4,31	4,89	5,53	6,26	7,08	7,99
15	3,64	4,18	4,78	5,47	6,25	7,14	8,14	9,27
16	3,97	4,59	5,31	6,13	7,07	8,14	9,36	10,75
17	4,33	5,05	5,90	6,87	7,99	9,28	10,76	12,47
18	4,72	5,56	6,54	7,69	9,02	10,58	12,38	14,46
19	5,14	6,12	7,26	8,61	10,20	12,06	14,23	16,78
20	5,60	6,73	8,06	9,65	11,52	13,74	16,37	19,46
21	6,11	7,40	8,95	10,80	13,02	15,67	18,82	22,57
22	6,66	8,14	9,93	12,10	14,71	17,86	21,64	26,19
23	7,26	8,95	11,03	13,55	16,63	20,36	24,89	30,38
24	7,91	9,85	12,24	15,18	18,79	23,21	28,63	35,24
25	8,62	10,83	13,59	17,00	21,23	26,46	32,92	40,87
26	9,40	11,92	15,08	19,04	23,99	30,17	37,86	47,41
27	10,25	13,11	16,74	21,32	27,11	34,39	43,54	55,00
28	11,17	14,42	18,58	23,88	30,63	39,20	50,07	63,80
29	12,17	15,86	20,62	26,75	34,62	44,69	57,58	74,01
30	13,27	17,45	22,89	29,96	30,12	50,95	66,21	85,85
31	14,46	19,19	25,41	37,56	44,20	58,08	76,14	99,59
32	15,76	21,11	28,21	37,58	49,95	66,21	87,57	115,52
33	17,18	23,23	31,31	42,09	56,44	75,48	100,70	134,00
34	18,73	25,55	34,75	47,14	63,78	86,05	115,80	155,44
35	20,41	28,10	38,57	52,80	72,07	98,10	133,18	180,31